DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

EDITED BY EDWARD LIVEING, B.A.

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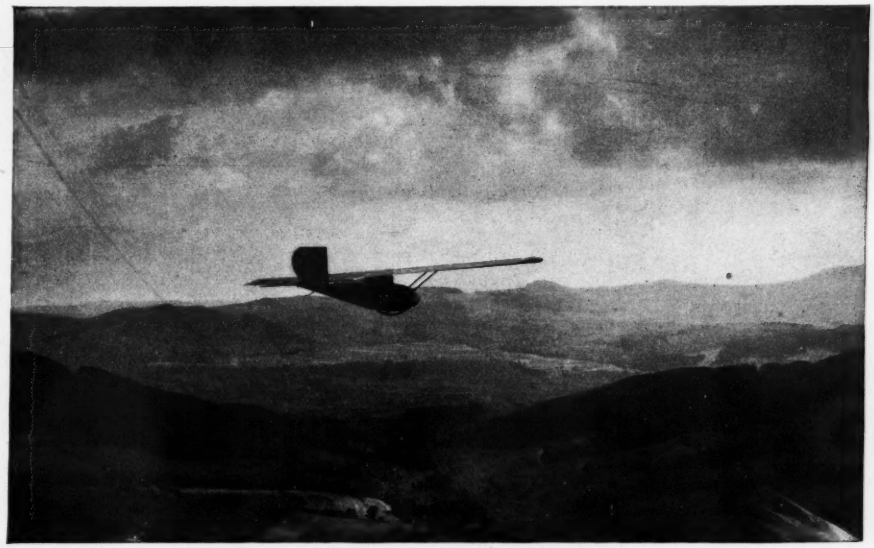

A MODERN GERMAN GLIDER
Showing the type of country suitable for gliding

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DISCOVERY. A Monthly Popular Journal of Knowledge.

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Editorial Notes

ON the eleventh day of this month we celebrate the fourth anniversary of the Armistice. It is impossible to look back on the past five years without a feeling that civilised nations and civilised individuals have so far failed to cope with the collective and individual emotions resulting from the war. There is not a nation in Europe, excepting the Scandinavian countries, and Denmark, and one or two small states, that has not lost thousands of its citizens in war and revolution since the Armistice. Russia has been bled white with anarchy and famine; Poland has fought with Russian invaders and in her turn invaded Russian provinces; Germany has experienced two revolutions and has fought the Poles in Silesia; Montenegro has rebelled against Jugo-Slav domination and been subjected by force of arms; Spain has carried on protracted fighting in Morocco; France has defended her interests in Syria; England has lost thousands of her men in Russia, Mesopotamia, Palestine, and Egypt; there has been civil discord in Ireland and in Italy. Lately we have been faced with a most dangerous crisis in the Near East, brought about by the age-old hostility between Greeks and Turks.

* * * * *

This is only one side of the picture. The effects of war—unemployment, bereavement, sharp changes in social life, reaction after a life of strain and excitement—upon the individual have been overshadowed in the Press by these events affecting the general life of nations. We ask our readers to face the facts and put this question to themselves: "Do I know of a single family or a single individual who has come out of these last few years unscathed in mind as well as in body?" We feel sure that anyone whose lot it is to mix a great deal with his fellow human beings will give a negative answer to this question. From day to day he encounters war marriages which have not turned out successfully, pathetically neurotic men and women who have no aims in life except those pleasures which will take them away from its hard realities, people who have lost faith in their religion, who do not know where to turn in search of that thing by which men live—a philosophy to guide their actions—cynicism, uncertainty, despair, a revolt against traditions in social and political affairs, in art and literature.

* * * * *

War and its aftermath have been the direct and immediate causes of the present state of things, but only the immediate causes, only the agents which have matured the fermentation. In a sense we may consider all the present international chaos as mirroring the chaos in the minds of each one of us. On every hand there are signs of a conflict between the old order which wishes to return to the past and the new order which reaches out to grasp new ideals. But, however dimly we realise it, is not some such conflict taking place in our own minds? Are we not striving to get out of ourselves and expand into the world around us? And, surely, the sooner we as individuals can realise our essential similarity to every other individual, that what we dislike in others is really what we dislike in ourselves, that in losing ourselves in others we gain our true selves, the sooner will nations cease from mutual distrust and warfare. We urgently need "to take arms against a sea of troubles, and by opposing end them." The "slings and arrows of outrageous fortune" will then disappear from our own lives, and gradually from the life of the world. Neither reaction nor revolution will carry us out of our present difficulties, but an orderly progress based on each individual giving himself in work, sympathy, and love to his fellow men.

Gliding Flight

By "Rafex"

THE remarkable performances of certain German gliders starting from the summit of the Wasserkuppe in the Rhone valley during the last two years have aroused popular interest in a subject which is difficult to assess at its true importance. It is, of course, the fact that the progressive gliding experiments of Lilienthal, Pilcher, Chanute, and others led directly to those of the Wright brothers, which in their turn resulted in the invention of the first successful power-driven aeroplane; and therefore the aeroplane may be said without question to owe its birth to gliding. On the other hand, it is at least debatable whether we have not now got beyond the stage where anything further can be learnt by such embryonic flying machines, and have not advanced to the point where laboratory experiments, checked by full-scale tests, provide the true scientific road to further development. Be that as it may—and we will return to the subject later—no consideration of the sport, or science, of gliding can hope to be complete without a brief outline of the achievements of the pioneers, which gives a measure of the merit of recent advances as well as a glimpse of the foundations upon which all modern progress has been built.

The "father" of all gliding was Otto Lilienthal, whose first experiments, with flapping-wing models, were made at the early age of thirteen. It is an interesting example of the tortuous path frequently followed by scientific development that his later gliding experiments, which were perhaps the first practical step towards the modern aeroplane, were intended by him as a preliminary to the production of an ornithopter. He realised the importance of overcoming the difficulty of maintaining equilibrium in the air, and for this purpose made many glides with fixed wing machines, but he does not appear to have visualised the aeroplane of which they were the precursors. Lilienthal started in 1891 by making jumps from a spring-board in the garden of his house at Lichtefelde, on the outskirts of Berlin. During the next three years he tried several suitable mounds in the neighbourhood and made many short glides over a gravel pit on the edge of which he had built a shed, from the top of which the jumps were made. In 1894 he had a small hill 50 feet high specially constructed from a mound of earth, with a shed for housing the gliders sunk in the top. Shortly afterwards he moved to his final experimental ground among the sand-hills at Söllen.

Lilienthal's gliders were of the simplest possible form with no mechanical means of controlling the balance. The earlier types were of monoplane design with the wing on each side stiffened by wooden ribs, radiating from a point near the operator's shoulders, who occupied an upright position with his weight carried on padded supports under the armpits. Balance was maintained entirely by moving the legs to alter the position of the centre of gravity. A horizontal fin was fitted at the rear which gave some automatic fore-and-aft control, as it was designed to yield slightly in an upward direction under the influence of wind-gusts. Above this horizontal surface was a vertical fin which was not movable. In spite of the crudity of this method of maintaining balance, Otto Lilienthal succeeded in making glides of over 1,100 feet, starting from a point 150 feet above the surrounding plain. In his own account of these glides he says [1]: "I often reach positions in the air which are much higher than my starting-point," and, "At the climax of such a line of flight I sometimes come to a standstill for some time, so that I am enabled while floating to speak with the gentlemen who wish to photograph me." There does not appear to be any record of the actual time he remained in the air on any of his glides, but enough has been said to show that he appears to have had considerable control over the balance of his machine simply by moving his body. The biplane gliders, on which his later experiments were made, were in all essentials precisely the same in principle as the monoplanes. They had a total wing surface of about 200 square feet, with a span from wing-tip to wing-tip of 18 feet, which enabled him to glide straight off the top of the hill "almost horizontally," without any preliminary jump, in a wind of 20 miles per hour. Lilienthal unfortunately met his death while gliding on Sunday, August 9, 1896, but not before he had shown the way to other practical experimenters and obtained much laboratory information of inestimable value on aerodynamics.

The mantle of Lilienthal fell on Percy Pilcher,[2] a young English naval architect and marine engineer, who took up gliding in 1895, when he built his first machine. He visited Lilienthal in the same year and made one or two glides on the German's biplane glider. Pilcher, however, preferred the monoplane, and all his own machines were of that type. Fig. 1 shows him in the air on his most successful glider named the "Hawk," which bears a striking resemblance in general outline to Lilienthal's monoplane and was undoubtedly influenced by the visit to Germany. It had a supporting surface of 180 square feet with a span of 23 feet 4 inches and chord of 8 feet 4 inches, the overall length being 18 feet 6 inches. It was con-

[1] *The Aeronautical Annual*, No. 2 (1896), p. 16.

[2] *The Aeronautical Classics*, No. 5: "Gliding," by Percy Pilcher.

structed of bamboo covered with linen and only weighed 50 lb. This machine on Pilcher's death came into the hands of the Aeronautical Society of Great Britain (now the Royal Aeronautical Society), of whose Council he was a member, and is now deposited in the Scottish National Museum at Edinburgh on permanent loan. Pilcher made many glides on the banks of the Clyde near Cardross, and at Eynsford in Kent. His best glide was made at Eynsford in June 1897, when he started from the top of a hill, glided right across the valley at a considerable height, and landed safely on the opposite hill after a flight of over 250 yards. Pilcher also became a martyr to gliding, on Saturday, September 30, 1899, when the tail collapsed and he fell to the ground from a height of 30 feet in the grounds of Stanford Hall, Lord Braye's seat at Market Harborough.

The next step in the development of gliding was effected by Octave Chanute,[1] an American who began experimenting in 1896 near Chicago. After building a Lilienthal-type machine he came to the conclusion that the German and Pilcher were on wrong lines in relying on movements of the body for the maintenance of balance, and evolved the principle of so arranging the wings that they automatically moved under the influence of a gust, returning to their original position under the action of springs after the gust had passed. In his early machines this was done by allowing the wings to fold slightly backwards, but in the later types they were pivoted round the fixed front edge so as to permit the rear edge to yield in an upward direction. Chanute also realised the importance of the theories of Alphonse Pénaud, who as early as 1877 had discovered the balancing effect of having a tail set at a less angle than the main wings, which introduced a longitudinal "dihedral angle." The "Pénaud tail," which is in principle a feature of all modern aeroplanes, was first incorporated in a man-carrying machine by Chanute. Many thousands of glides were made in Chanute's gliders between 1896 and 1903 without accident, and these may be said to have led directly to the successful experiments of the Wright brothers.

Before proceeding to their work, however, mention must be made of a pioneer whose work is in some respects more remarkable than any of those we have mentioned, although it seems to have become almost forgotten, and few people in this country appear ever to have heard his name. This was Professor J. J. Montgomery, and it is sufficiently remarkable that he claims [2] to have glided a distance of 600 feet so long ago as 1883—nearly ten years before Lilienthal. But his chief claim to fame is his remarkable success at a later date in solving the problem of automatic stability. After devoting nearly twenty years to laboratory experiments and tests with models he, in 1903, again built a full-scale glider which had arched wing surfaces, the extremities of which could be pulled down, or "warped," by cords at the will of the operator; whilst in rear was a large elevator. With this machine the most remarkable feats were performed by three professional parachutists whom Montgomery engaged to demonstrate the principle. In 1904 one of these parachutists, Maloney, made a glide which it would be difficult to equal even at the present day. He was raised by a balloon to a height of 3,000 feet when he

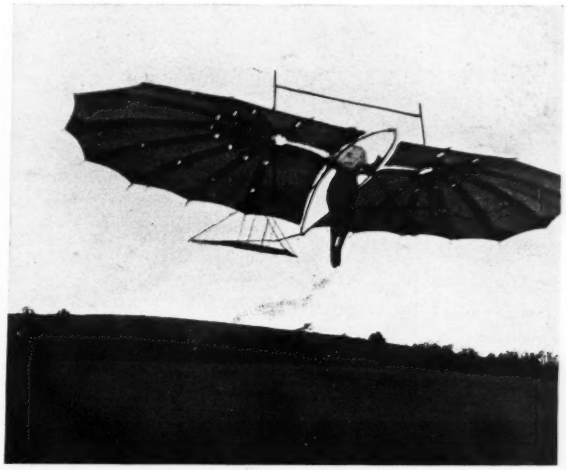

FIG. 1.—PERCY PILCHER ON HIS LILIENTHAL-TYPE GLIDER THE "HAWK."
From a snapshot taken in 1896.

cut himself adrift. "As he cut loose [from the balloon] he lost his direction. We told him to come back to the starting-point. He started to fly towards a distant city. In five or six minutes he detected his mistake, turned round, and started to fly towards us. . . . Finally, he came back near the point of starting. He could not make the exact point for he had lost a great deal of elevation . . . so he made a circle and came to the earth." [3] On another occasion in the same year Maloney, "in trying to make a very short turn during rapid flight pressed very hard on the [wing warping] stirrup and made a side somersault. After this movement, the machine continued on its regular course. And afterwards Wilkie, not to be outdone by Maloney, told his friends he would do the same, and in a subsequent flight made two side somersaults, one in one direction and the other in an opposite." [4] After reading this one has to rub one's eyes and remember

[1] *The Aeronautical Annual*, No. 3 (1897), p. 30; and *L'Aérophile*, vol. xi (1903), p. 171.

[2] *Aeronautics*, vol. iii, p. 63.

[3] Ibid., p. 64.

[4] *Vehicles of the Air*, by Victor Lougheed, p. 144.

that these experiments took place about the time when the brothers Wright were perilously edging round corners on their first power-driven machine and inquiring into the mystery of its tendency to side-slip and "stall" while doing so. A further commentary is afforded by the accident in September this year to Herr Klempferer, one of the most successful present-day exponents of gliding in Germany, who was released in his glider from a kite-balloon at a height of 4,000 feet and fell to the ground without gaining control of his machine.

In view of these amazing performances, which are well authenticated, it seems extraordinary that one has never seen a reference to Montgomery in any of the numerous articles on gliding which have been published recently.

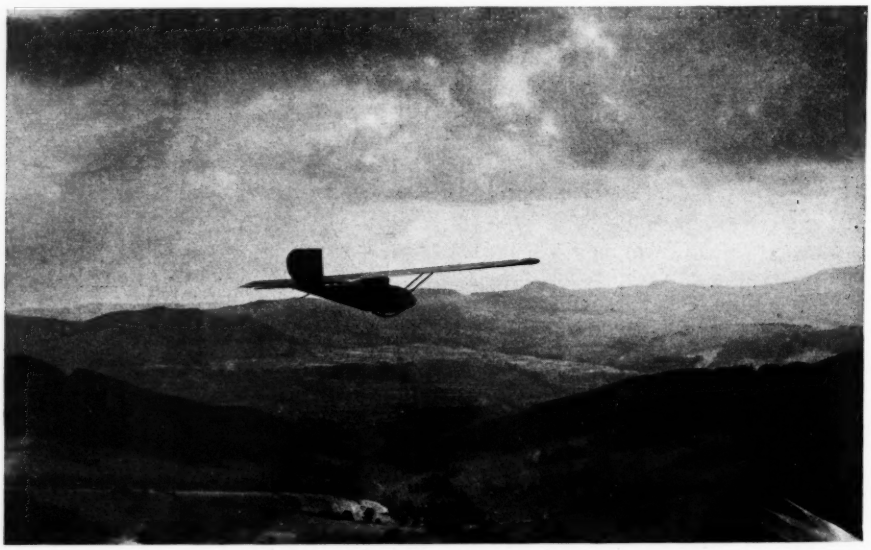

FIG. 2.—A MODERN GERMAN GLIDER.
Showing the type of country suitable for gliding.

It is not proposed to deal here at any length with the work of Wilbur and Orville Wright which eventually led to the successful development of the aeroplane as we now know it, since a detailed account already exists in a readable and accessible form.[1] But readers of DISCOVERY may probably not be aware of the fact that in 1911 Orville Wright set up a world's record for soaring by remaining in the air over the same spot for 10 minutes 1 second, which possibly remains unequalled as a demonstration of control by all the long gliding and circling flights, up to three hours in duration, made in Germany during August this year.

The improvement in performance, so far as time spent in the air and distance covered are concerned, is due to the advance that has been made in the intervening years in the aerodynamic efficiency of machines, combined with the increased skill of the pilots. It must be remembered that the pioneers were using gliders in the effort to teach themselves the art of maintaining equilibrium in the air. The present-day experimenter, on the other hand, comes to the sport with all the accumulated experience of many hundreds of hours spent in the air in aeroplanes, and the resulting confidence, and knowledge of what to do in an emergency. So far as concerns the efficiency of machines, even down to the days of the Wrights, little was known of the characteristics of wing-forms or the amount of resistance offered by different-shaped bodies. And yet these are points of vital importance to the gliding angle of the machine, which decides how many feet it will travel forward for each foot it drops towards the earth under the influence of gravity. In the average aeroplane of to-day this rate of descent, with engine cut-off, is in the neighbourhood of 1 in 11, while some of the most successful recent German gliders are said to have a gliding angle of 1 in 16 in calm air compared with the 1 in 6 of Lilienthal. In its simplest form gliding is analogous to "coasting" on a bicycle down a steep hill, the slope being provided in the case of the glider by the passage of the air along the wings. In the more complicated examples of gliding flight it is important to remember this cardinal principle: that the machine is always gliding downwards *through the*

[1] *The Life and Work of Wilbur Wright*, published by the Royal Aeronautical Society, London.

air even though it may be rising in relation to the ground under the influence of an up-current of wind. That is why the selection of the site is so important for gliding experiments; because the duration of the glide may, by a skilful pilot, be prolonged by taking advantage of the up-currents which are to be met with on the windward side of hillocks or small inequalities in the ground with the wind in certain directions. In the Wasserkuppe region in Germany, where such remarkable results have been achieved, the ground towards the south falls away rapidly in a smooth slope which is admirable for simple glides. But it is on the west that it is most favourable for spectacular performances, though even there only when the direction of the wind is also from the west. This enables the glider to get into an up-current immediately on leaving the ground, through which he can gain sufficient height to enable him to circle and make for a series of low hills at the foot of the main slope, which each possesses characteristic wind eddies and currents which can be turned to advantage. As a result of a careful study of these local currents over many years—this country was first used for gliding in 1912—the German expert gliders are enabled to put up performances which could only be equalled elsewhere after prolonged study of local meteorological conditions.

True "soaring" flight, if such be possible, does not appear yet to have been achieved in the sense in which birds are said to soar: by which is meant effortless horizontal flight under conditions where no up-current—whether arising from configuration of the ground or from the heating of the air by the sun's rays—appears to exist. Various theories have at different times been advanced for this phenomenon, the most probable of which is that, even in an apparently steady horizontal wind blowing over the surface of a perfectly flat plain, there are regular or irregular pulsations, the vertical component of which a bird is able to turn to account by minute adjustments of the angle of its wings. An attempt is being made to test this theory in certain special gliders which have recently been built in Germany. The rear edges of the wings are free to move up and down against helical springs, which it is hoped will enable them to adjust themselves rapidly to these supposed pulsations, and so take advantage of their effects. Whether or not this will be successful remains to be seen, but to a student of the past it seems strangely reminiscent of Octave Chanute's system for maintaining longitudinal equilibrium, and one cannot help feeling that, after allowing for all the aerodynamical development that has taken place in the meantime, there must be more in it than that or he would have discovered it.

It is, as has already been hinted, impossible, in the writer's opinion, yet to say whether or not gliding has a utility as a means of scientific observation midway between the laboratory and the full-scale aeroplane. The chain between the two is admittedly not yet complete, but the facilities for observation in a glider would appear to be limited, as the operator is fully occupied with the maintenance of his position in the air. This difficulty might, it may be said, be overcome by carrying a passenger to do the observing, but he would not have the intimate "feel" of the machine that the pilot has. On the other hand, the weight of the necessary recording instruments for taking mechanical observations of the phenomena would be very considerable and likely to be prohibitive.

Whether or no the glider proves a scientific instrument, it certainly provides a cheap and attractive way of gaining a knowledge of the air; with the proviso that extrication cannot be made from a difficult position by switching on the engine, as in an aeroplane, and the most dangerous situations are likely to occur where there is little or no air-space below in which to recover.

The Fear of Death

By F. A. Hampton, M.B., M.C.

THE average man is wisely too preoccupied with life to be much concerned with the idea of death; in fact it may be doubted whether the idea of death as such plays any significant part in the life of the normal individual, for it would seem to be very difficult for man to form a subjective idea of death, that is, to imagine himself either as having ceased to exist or (the slightly easier alternative) as existing in some fashion outside his material surroundings. If we assume that the mind was evolved not in order to enable man to think, but to enable him to act more efficiently, then it is not surprising that it should prove inadequate to so sterile and useless an activity.

A situation that threatens life, or the anticipation of such a situation, may fill us with fear, and it is well for our self-protection that it should do so; but if we examine this fear it is rare to find that it contains any conception of death, and we can hardly say that a distinct fear of death stands out from the general protective emotion of fear evoked by any circumstance that threatens injury or destruction.

The late war provided situations enough of this kind, and if we inquire into the feelings of those who were exposed to them, we find that the fear was rather of the immediate physical violence than of its

possible results, and if death came into consideration at all, it was usually thought of as an escape from a situation that was almost physically unbearable. This attitude is well described in the following passage from *The Diary of a Dead Officer*, by the late Arthur Graeme West. The passage was written immediately after a heavy bombardment, and the sensations recorded are typical of those of many others in like circumstances. "After we had been shelled for about two and a half hours on end my nerves were shaky and I could have cried for fright as each shell drew near, and longed for nothing so much as to rush down a deep cellar. It was merely consideration of the simple fact that a shell, if it did hit me, would either wound or kill me—both of which were good inasmuch as they would put a pause to this existence—that kept me up to my standard of unconcern. And the more I experience it, the more fear seems a thing quite apart from possible consequences. I feel afraid at this moment. I write in a trench that was once German, and shells keep dropping near the dug-out. There is a shivery fear that one may fall into it or blow it in. Yet *what* do I fear? I mind being killed because I am fond of the other life, but I know that I should not miss it in annihilation. It is not that I fear."

This reaction to a situation threatening death becomes more comprehensible when we remember that fear is a self-protective emotion giving us alertness to beware of danger and wings to escape from it. The animal reacts to danger without, it may be supposed, being aware of the possibilities of harm involved, and man appears to react to danger in a similar way, as we have seen in the case quoted above. For although man is aware, and often acutely aware, of his danger, yet the intensity of the fear experienced does not appear to be always quite proportionate to the extent to which his life is threatened; for example, people were more fearful of air-raids than of the influenza epidemic, although the latter was by far the more deadly of the two. In this instance the air-raids were a prepotent cause of fear because, presumably, they evoked the emotion through its most primitive channel of stimulation, that of threatened violence; it is useful for an animal to feel frightened at violence, but to experience fear from a feeling of illness would serve no purpose.

Against all the foregoing it may be said that it is a truism that we are afraid of death, and to gainsay it is mere sophistry and playing upon words; but the above considerations seem to lead to the conclusion that we have focused upon the idea of death, or, more strictly, upon the idea of dying, a general protective emotion of fear that does not properly belong to it, and that we have, in imagination, endowed death with a fearfulness that reality does not substantiate. And it seems not impossible that by looking at death from this angle we may divest it of some of the terror that, at least in words, we attribute to it. Indeed, if we allow ourselves to examine this idea of terror, it seems to have an archaic, almost superstitious, quality, and to be incompatible with the calmness with which ordinary men and women, of no particular courage or stoicism, may be observed to meet it.

This introduces the idea already suggested, that, when we speak of the fear of death, we are commonly thinking of the idea of dying, and here it must be borne in mind that, although death may be an undiscovered territory, yet we may claim to know something about dying. For we have on record the experiences of many people who, from drowning, asphyxiation, or other causes have sunk into a state of unconsciousness that, had it lasted but a little longer, would have passed the limit of recoverability and ended in death. These experiences show a remarkable agreement in the absence of fear and even of discomfort; in many cases there is a feeling of lightness and freedom, sometimes of travelling with great speed, sometimes of complete tranquillity that is almost pleasurable. We may quote in this connection the last words of William Hunter, the great anatomist: "If I had strength enough to hold a pen I would write down how easy and pleasant a thing it is to die."

In a similar way the certain expectation of death seems to contain little of the terror with which our imagination tends to endow it. Dostoevski, the Russian novelist, standing on the scaffold awaiting execution, and with no idea that he might be reprieved, calmly calculated exactly how many minutes he had to live and seemed to be preoccupied with an almost purely intellectual interest in the great amount of "living" that could be done in a short space of time. A man who marvellously escaped after falling off a tall building seemed to have felt little during his descent except a mild wonder at the length of time he was taking to reach the ground.

There is no reason to suppose that these experiences are exceptional except in that they were recorded, and we are entitled to assume that they represent the normal sensations that accompany the final vanishing of consciousness and the typical attitude in the expectation of death.

The fact that our conception of dying is derived from our observation of the process of death in others, rather than from the necessarily rare data that we have spoken of above, probably accounts for some ideas that are commonly held, but are certainly incorrect, notably for the idea expressed in the phrase "the agony of death." The word "agony" seems to have come into the language from the New Testament

where the Greek word "ἀγονία"[1] (literally, "a struggle") is used to describe the spiritual conflict of Christ in the garden of Gethsemane; it came to be employed (as it is now almost exclusively in French) to describe the act of death, possibly because the spasmodic twitchings that are sometimes observed to occur at the point of death, though long after the loss of consciousness, were imagined to be the physical result of the soul struggling to leave its habitation. It is but comparatively lately that the word acquired its present commonest meaning of great pain, thus colouring our conception of dying—and not only in old wives' tales—with an idea of pain and distress that, as has already been remarked, reality does not substantiate.

We have said that in the life of the average man the conception of death, of his own death that is, plays little part; but there are many who seem to be oppressed by the sense of their own mortality, and as they are commonly reflective and thoughtful people, and were at one time numerous among the preachers and moralists, there is a tendency to give them credit for penetrating beneath the surface of life and reaching some sort of fundamental truth, unfruitful and obvious though it be. The attitude of such an individual towards life tends to be that of a critic or spectator; it is an attitude of self-consciousness, for he sees himself in relation to life and as it were standing apart from it.

This attitude is well pictured in the following dream: "I was standing on an incline beside a kind of great moving staircase on which were all sorts of people, many of whom I knew. They were all walking and being carried upwards. I was the only one who was not on the moving stairway. I felt very insecure, and at times I seemed to be slipping downwards." The dreamer went on to say, "This is rather like what I feel when I am awake. Other people seem to be going ahead and moving with the stream, but I am standing still."

The same individual occasionally had a nightmare in which he felt that he was slipping down a smooth incline towards some sort of abyss—a dream that proved to be a dramatic representation of the fear of death from which he suffered in waking life.

If we are able to investigate a personality of this type where a fear of death, or its slighter degree of a sense of mortality and impermanence, is coupled with the attitude of standing outside life, we often find that at the bottom it is a fear of life itself that enforces an attitude of aloofness and detachment. On further investigation we find in many cases that the fear of life is directed against one special aspect of it, against the sexual side of life, and in dreams we find love and death linked together as objects of fear. This becomes more understandable when we realise that the reproduction of life is, on the biological level, antagonistic to the life of the individual; when reproduction is accomplished the biological goal is reached, and in many of the lower animals death follows immediately. Some hint of this may persist in the sense of finality and the dying down of an impulse that accompanies the achievement of any end, especially one so ardently pursued as that of love. There is a Spanish proverb, "When the house is finished, Death enters in," and Sir Thomas Browne, speaking of marriage (in anticipation, it may be noted), says: "Thus I perceive that a man may be buried alive and behold his grave in his own issue."[2]

The psychological equivalent of this biological antagonism is a deep unconscious conflict between the egoistic impulses and the sexual instinct; a conflict understandable enough since a great passion may overwhelm an individual, transcend all his old values, and commit him to acts of self-forgetfulness of which he had believed himself incapable. In a slighter and more subtle way the conflict may appear as reluctance to admit another within the circle of the personality:

> "Love is a breach in the walls, a broken gate,
> Where that comes in that shall not go again;
> Love sells that proud heart's citadel to fate."[3]

This reluctance seems to arise partly because there is a feeling of safety in keeping something at least of the personality secret and inviolate, and partly because for one individual to admit another entails transferring to him or her some of the love previously attached to the self. This aspect of the conflict is admirably expressed, from the man's point of view, in D. H. Lawrence's last novel, *Aaron's Rod*, and in it is also expressed what appears to be our solution of the conflict. For man seems to endeavour to reach beyond the biological goal of love, (thus robbing it of the aspect of finality), towards some enduring intimacy that shall abolish the deep feeling of loneliness and isolation that his highly developed consciousness has inflicted upon him as the price that he must pay for its advantages.

It is interesting to notice how common in poetry is this theme of mortality and the transience of all things beautiful and desirable:

> "Beauty vanishes, beauty passes;
> However rare—rare it be."[4]

And there is perhaps a tendency to assume that such a view of life is the inevitable result of any steady

[1] New Oxford English Dictionary.

[2] *Religio Medici*, part 2, sect. 14.

[3] Rupert Brooke. (*1914 and Other Poems.*)

[4] Walter de la Mare. (*The Listeners*, etc.)

and clear-minded reflection upon it, and to forget, in the beauty and perfection of its presentation, that such a view is essentially the idiosyncratic expression of a particular temperament ; for this regret over the fleetingness of life seems to be a projection on to external things of the writer's uneasy feeling of his own mortality, and in the older poets the general " moralisation " often leads on naturally and naïvely to some such personal reflection as :

> " Thow I be of muchè prise,
> Fair of face and holden wise,
> Mine fleich schall faden as flour-de-lys
> Whan I am ded and leid in cley." [1]

It is not the love of life, but the fear and the renunciation of life, that begets the fear of death, and it is significant that the Abbot of a Benedictine Monastery, writing recently in the Chronicle of his Order, records that the greatest difficulty which he has to combat in securing the peace and tranquillity of mind among the monks under his charge is the fear of death.

The temperament that holds itself aloof from life merges into the neurotic, and in this sphere we find the fear of death occurring fairly frequently as a symptom and from various causes, but they are of more technical than general interest, and are fully dealt with in the textbooks of psychopathology.

We have tried to show that, firstly, the fear of death is largely compounded of the fear of dying, upon which we have, in imagination, concentrated a generalised instinctive reaction to danger and especially to violence. We are entitled to say " in imagination " because, except in comparatively rare cases, neither the imminence nor the process of death seems to cause fear. Secondly, that a sense of mortality, that is tolerably common and easily deepens into a fear of death, is the expression of an inadequate reaction to life.

But over and above there remains a fear of death as the unknown, and the unknown is of itself a powerful cause of fear, especially in primitive races. But, with increasing mental development and with the growth of intellectual curiosity, the unknown as such loses its capacity for inspiring terror ; it is an instinctive form of fear that belongs essentially to the childhood of man and to the childhood of the race, and one day, perhaps, it may be to a great measure outgrown, and the traditional " philosophic " attitude towards death become common to everyone. Meanwhile, as an example of such an attitude, we may do worse than take the fine common sense of Mantaigne : " I would have a man to be doing and to prolong his lives offices as much as lieth in him, and let death seize upon me, whilst I am setting my cabiges, carelesse of her dart, but more of my unperfect garden." [2]

[1] Author unknown. MS. of the beginning of fifteenth century. (*Early English Lyrics.* Chambers and Sidgwick.)

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Inflation and Unemployment

By Douglas Knoop, M.A.

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RECORDS extending over a considerable number of years show that before the war the state of trade in the principal industrial countries tended to be alike. When trade was good in the United Kingdom, it tended to be good simultaneously throughout Western Europe and the United States, and similarly when trade was bad. Since the war, this tendency to similarity of trade conditions in different industrial countries no longer holds good ; the striking contrast during the last two years or so between trade conditions in the United Kingdom and those in Germany has been a matter for general comment. The cause of the difference almost certainly lies in the fact that Germany continued to pursue a policy of inflation after it had been given up in this country. If inflation has such a favourable influence on trade conditions and on the state of unemployment, it may not unreasonably be asked, " Why should not we adopt the same policy in this country ? " The object of this article is to examine the connection between inflation and trade conditions, with a view to showing why a policy of inflation is not to be recommended as a method of dealing with unemployment.

Inflation consists in increasing the amount of currency in circulation in excess of that which is needed to perform the transactions of the community. So long as a country's currency is based on a genuine gold standard, i.e. so long as its paper money is immediately convertible into gold and so long as that gold may be melted down or exported without restrictions, there can be no real question of inflation. It is true that the amount of credit instruments may be increased somewhat, but the total amount of credit that can be erected on a given quantity of currency

[2] Montaigne's Essays. First Booke, chap. 19. Trans. Florio.

is more or less limited. If currency or credit instruments are multiplied beyond requirements, then gold from the currency will be exported, hoarded, or utilised for industrial purposes, and the total amount of currency and credit instruments available for making payments will thus be automatically reduced. Once all the gold has been drained out of the currency, or once the real convertibility of the paper money has been abolished, then the automatic check on the continued existence of excessive supplies of currency and credit instruments disappears, as paper money which is not immediately convertible into gold is not readily acceptable abroad in large quantities, except possibly for speculative purposes. Additions to the currency tend to remain in the country of issue, together with the credit instruments which can be based on the additional issues. The supply of currency and credit instruments available for financing business becomes much larger than would have been the case had the currency still been based on a genuine gold standard. As a consequence, the exchanging power of each unit of currency tends to fall, or, in other words, the price of commodities tends to rise.

An increase in the general level of prices leads to a demand for more currency to enable trade to be financed at the new price levels. If additional currency is issued, it tends to cause prices to rise still further, thus leading to renewed demands for more currency. Unless a very determined effort is made to break the vicious circle, the rise in prices and the increase in the amount of currency tend to grow at ever accelerating rates.

Under normal conditions, when the general level of prices in a particular country rises, whilst prices in the rest of the world remain more or less constant, imports into the country with rising prices tend to increase, and producers in that country find it more difficult to sell goods both at home and abroad. When, however, prices in a particular country rise on account of currency inflation, the consequences are quite different; sales of that country's produce both abroad and at home are greatly encouraged, and imports are discouraged. Foreigners are keen to buy, because they find that they can thus secure goods more cheaply than at home. This is due to the fact that when a country adopts a policy of inflation, the prices of commodities tend to rise more slowly than the prices of foreign currencies. E.g., in Germany £1 may rise in price 300 times from 20 marks to 6,000 marks, whilst the price of a particular commodity rises only 150 times from 20 marks to 3,000 marks. In England the price of the commodity remains unchanged at 20s. Then an Englishman with £3 to spend can either buy three articles at 20s. at home, or can exchange his £3 for 18,000 marks and with that can buy six articles at 3,000 marks. Inflation, although it leads to a rise in prices in terms of home currency, makes goods cheaper in terms of foreign currencies, and thus encourages exports.

Inflation also encourages sales at home, but for a different reason. Residents in a country with a rapidly depreciating currency are anxious to buy commodities of all sorts—so far as their means will permit—in order either to spend the money on present enjoyments whilst it still has the same purchasing power, or to secure durable commodities which do not immediately deteriorate in value if they are kept for a time. To keep one's surplus resources lying on deposit at a bank in countries like present-day Germany or Austria is analogous to keeping beer in a barrel that leaks: the deposit, so far as its purchasing power is concerned, steadily diminishes. Owing to rapid depreciation, home currency ceases to be a satisfactory store of value, and there is consequently a very strong inducement to spend it promptly, which is likely to stimulate home trade for the time being. It does not necessarily follow, however, that the bulk of the currency spent is devoted to the purchase of goods; stock exchange securities may prove the attraction, especially ordinary shares in industrial undertakings. Indirectly these purchases help industry by facilitating the raising of additional capital. On the other hand, the holders of depreciating currency, instead of buying goods or securities, may buy foreign currencies, which does not benefit industry. This tends to occur more frequently in the later, than in the earlier, stages of inflation, and will be referred to again below.

During the early stages of inflation producers find ready markets for their goods both at home and abroad, trade flourishes and unemployment falls to a low point. There is, however, another side to the picture which is a good deal less pleasant; the trade prosperity is artificial and is secured only at a heavy price. It is this price which we must now examine.

The constantly rising prices associated with inflation affect various sections of the community differently, according to the source from which the income is derived.

(1) In the worst position is the rentier, more particularly the person who derives his income from fixed-interest bearing securities; the purchasing power of his fixed income is constantly diminishing. Thus many people in Germany and Austria who possessed a modest competence before the war are now virtually paupers. Very similar in practice is the position of a person who derives his income from the rent of land and buildings, though in theory he should be much better off, as rents should tend to increase with the rise in the general level of prices.

In practice, however, Governments intervene and pass some kind of Rent Restriction Act which prevents landlords from raising rents to anything like the same extent as prices have risen. As a consequence, the rentier who derives his income from rents is nearly, if not quite, as badly off as the rentier who derives his income from fixed-interest bearing securities. A person whose income comes from dividends on ordinary shares is in a different position, analogous to that of a business proprietor, and he may best be considered as such.

(2) In a distinctly better position than the rentier are the persons who earn wages, salaries, or fees, as there is a probability that they will be able to secure increases in remuneration which will more or less compensate them for the rise in the general level of prices. It is fairly safe to conclude, however, that these increases in pay will compensate them less, rather than more, for the rise in prices, as the old saying that " wages follow prices " contains a very large element of truth. At the very best, wages and salaries may be adjusted automatically in accordance with a scale based upon changes in the cost of living, but unless the calculations and the adjustments are made very frequently, the increases in wages will always lag behind the increases in prices, which will be a serious matter where prices are advancing at all rapidly. In the case of many wages and salaries, and more particularly in the case of fees, it is improbable that sufficiently prompt and adequate alterations can be made to maintain real incomes, in terms of commodities and services, at the old level.

(3) In the best position, in any case during the earlier stages of inflation, are the proprietors of business undertakings. This applies to the owners of private enterprises—farms, shops, factories, etc.—as well as to the ordinary shareholders of industrial and commercial companies. Selling prices tend to rise more rapidly than do costs of production, the interest charges being comparatively fixed and the wages bill tending to lag behind. Thus the margins between costs of production and selling prices tend to grow, and so consequently do the profits. Furthermore, the prices of all stocks held tend to increase, which helps to swell the profits. Thus inflation appears greatly to benefit the proprietors of business undertakings, even as it prejudices rentiers and the earners of wages, salaries, and fees. In reality, inflation is just as harmful to business proprietors as it is to other sections of the community, only it is necessary to look below the surface to discover the damage that is being done. Inflation causes business proprietors to use up their fixed and their working capital, but so long as the capital lasts, the losses that are really being incurred tend to be hidden by the favourable figures—expressed in terms of paper money—which fill the balance sheets.

We may first examine the insidious attack which inflation makes on fixed capital ; it takes the form of causing the provision for depreciation to be hopelessly inadequate. In a soundly conducted business, a sum, based on the estimated life of the plant, is charged as an expense each year against revenue, before ascertaining profits, in order to provide in due course for the replacement of worn-out plant. Thus if new machinery costing 1,000,000 marks had an estimated life of 10 years, the manufacturer would set aside each year 100,000 marks to provide for depreciation. At the end of 10 years he would have set aside 1,000,000 marks with which to replace the machinery and thus maintain his capital intact. If during the 10 years prices rise enormously owing to inflation, the 1,000,000 marks accumulated in the depreciation fund will prove utterly inadequate to defray the cost of replacing the worn-out machines. The bulk of the capital originally represented by the machines will be lost, the loss having occurred through the manufacturer charging his customers too little in respect of the use made of the machines.

In what concerns working capital which is employed for financing stocks of raw materials or other commodities required in connection with production, it is found that, owing to the great rise in prices, the money realised when the stocks are disposed of is not sufficient to pay for renewing the stocks. Thus, although handsome profits are made, in terms of paper money, every time goods are sold, in reality a loss is being incurred, and the firm's real capital, in terms of commodities, is being reduced.

Living on capital is not a course which business firms can follow indefinitely, though the evil day of a collapse can be postponed for a time by issuing new shares or by raising loans. If inflation continues to grow, the new capital will be lost like the old, and a time must come when people will no longer be willing to invest money in industrial undertakings, assuming they have any to invest ; this will certainly not be the case so far as the rentier class is concerned, which normally does a considerable share of the national saving.

For a time, successive doses of inflation cause trade to be brisk and employment good at the expense of ruining the rentier class, of prejudicing wage-earners and seriously prejudicing the salaried and fee-earning classes, and of gradually undermining the position of business proprietors by causing them to live on capital. " Good trade " based on this kind of rake's progress cannot continue indefinitely. (1) The most prompt reaction will be brought about by the adoption of a policy of currency deflation. Czecho-Slovakia

appears to be suffering at present from acute trade depression and unemployment for this very reason. (2) The mere stopping of inflation, without any attempt at deflation, will also bring about a complete change in trade conditions, though rather more slowly. The prices of commodities will tend to catch up to the price of foreign currencies, thereby cutting off the automatic bonus which had previously encouraged exports. Wages will tend to catch up prices, thereby eliminating an important cause of producers being able to sell cheaply. Sales both at home and abroad will be seriously reduced and employment will suffer accordingly. (3) If inflation is continued in ever-increasing doses, the evil day of a collapse in trade can be postponed a little longer. Nevertheless, a change in trade conditions will come in spite of inflation ; the factors which are likely to bring it about being as follows :

(i) The growing difficulty, if not impossibility, of obtaining sufficient credit from banks or capital from investors with which to finance trade. In terms of paper money, the sums required will be so enormous that the means to provide adequate advances will be lacking, even if the will to lend still exists.

(ii) The diminishing home demand for goods, brought about by an increasing tendency to employ any surplus available in the purchase of foreign currencies in preference to buying goods or industrial securities. Export restrictions may prevent goods being sold to the best advantage ; shares may become worthless owing to the collapse of business ; foreign currencies appear to offer the best prospects of appreciating and of being realisable in case of necessity.

(iii) The growing difficulty of financing abroad purchases of essential raw materials and food products. In the early stages of inflation, considerable funds for this purpose are secured by the sale to foreigners of currency and securities which they buy for speculative purposes in anticipation of an improvement in the exchange. When foreign speculators lose confidence in the ultimate recovery of the depreciated currency, this source of financing necessary purchases abroad dries up.

(iv) The growing disorganisation of the national finances, due to the absence of any steady basis on which to levy taxation.

(v) The growing difficulty of conducting trade in terms of the rapidly depreciating currency. Business will tend to be conducted in terms of foreign currencies or by means of barter. In a relatively self-supporting agricultural country, with a comparatively small trade, this might not matter very much, but in an industrial and commercial country largely dependent on trade, the practical elimination of a home currency system cannot fail very materially to diminish the amount of buying and selling, thereby correspondingly reducing employment.

The cumulative effect of these various hindrances to trade, when once they have begun to make themselves felt, as appears now to be the case in Germany, can hardly fail to bring about a most unfavourable state of affairs in a comparatively short time. In Austria the stage of trade stagnation and collapse has already been reached ; there inflation has lost its power to stimulate trade.

The stimulating effect of inflation on trade can best be compared with the stimulating effect of cocaine, or some similar drug, on human beings. It has to be applied in constantly increasing doses if it is to continue to stimulate, until ultimately the patient collapses from an overdose. Thus the final effect of inflation is to kill trade and to bring employment practically to a standstill in an industrial and commercial community.

The Attack on Mount Everest[1]

By R. N. Rudmose Brown, D.Sc.

THE attack on the summit of Mount Everest (29,002 ft.) began in 1921, when Col. Howard-Bury led a reconnaissance expedition whose aim was to discover the best route by which the final attempt could be made. Little accurate information about the regions lying around Mount Everest was available. Approaching from Tibet, the explorers found that the Rongbuk glacier, which seemed the obvious line of approach, afforded no practicable way, and that the western slopes of the mountains were unclimbable. Attack from the Kharta valley on the east seemed to be no more promising. At length, towards the end of the season, the problem was solved. The East Rongbuk glacier leads to the north-east crest of the mountain. The climbers reached the head of the East Rongbuk glacier from the Kharta valley and ascended the north-east col of Mount Everest, the Chang La, to 23,000 ft., that is to say, practically 6,000 ft. from the summit. This point was reached at the end of September. Bad weather cut short the climb, and the attempt had to be abandoned, when at last the road to the summit seemed to have been found. This

[1] The writer of these notes makes no claim to any special knowledge of the subject or of mountaineering in general, but some experience of glacier travelling and low temperatures in Arctic and Antarctic regions enables him to appreciate the conditions encountered on Mount Everest and its approaches. Acknowledgments are made to despatches published in *The Times* and to various articles in the *Geographical Journal*.

is not the place to dwell on the scientific results, but they were important both in geology and biology, while a very considerable extent of new ground was surveyed.[1]

This year the Mount Everest expedition took the field with high hopes of success. Gen. the Hon. G. C. Bruce, who was in command, left Darjeeling with the main body at the end of March, some eight weeks earlier than the start of last year's expedition. Experience had proved that the end of May or the first half of June was the best period for the great climb. The expedition was on an elaborate scale. It consisted of twelve members, and required a great deal of transport, largely because of the oxygen apparatus and elaborate photographic equipment. Tibetan yaks, bullocks, mules, and donkeys, beside numerous hillmen, were employed. The early start entailed many difficulties ; some of the animals were in poor condition, and the weather conditions as higher elevations were reached were anything but propitious. The expedition followed practically the same route through Tibet as the previous year, and eventually, at the end of April, all the party and its equipment were assembled at the base camp on the Rongbuk glacier at an elevation of 16,600 ft. The next step was to establish an advanced base on the north col at some 23,400 ft., provisioning it with stores and equipment, including a supply of oxygen, for work at high altitudes. Low temperatures and some trouble with Tibetan coolies caused unlooked-for delays, but a reconnaissance up the East Rongbuk glacier was successful in revealing a practicable route to the north col.

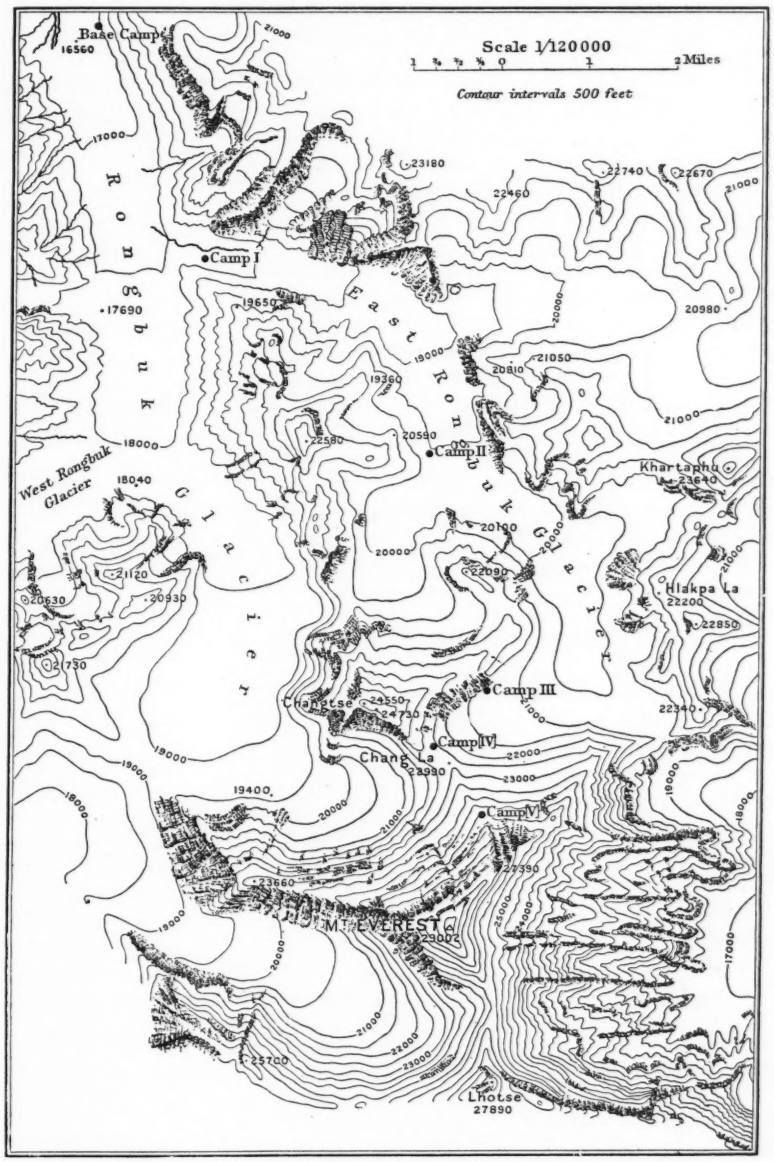
Camp I was established three miles south of the base camp at the mouth of the East Rongbuk glacier. It was provided with stone huts. From here a reconnoitring party set out on May 5 up the glacier, establishing Camp II at 19,360 ft. and Camp III on May 8 at 21,000 ft., under the towering cliffs of Changtse, the peak of 24,730 ft. which rises to the north of Mount Everest. This camp served as an advanced base to which the outfit was transferred as speedily as possible from the main base ten miles distant. No time was lost in looking for the route to the north col (Chang La). A reconnaissance party of Messrs. Mallory and Somervell established a camp (IV) just below the col on a convenient shelf. Several days later on, namely May 19, Messrs. Mallory, Morshead, Norton, and Somervell, with several porters, starting from Camp III, reached Camp IV and established Camp V at 25,000 ft. Two days later Messrs. Mallory, Norton, and Somervell climbed from Camp V to 26,800 ft. They found no considerable difficulties on the route, although the surface conditions were not good. No oxygen was used on this climb. Already the record in climbing altitude had been broken. The highest point previously reached by man was 24,583 ft., which was gained by the Duke of the Abruzzi on the Himalayan peak known as K_2 in July 1909. Mr. Mallory's party was only 2,200 ft. below the summit of Mount Everest, but at those altitudes even a short distance is a formidable task. They felt able to go higher when they decided to turn, but doubted their ability to get back if they continued. As it was, the descent to Camp III was painful and arduous : several of the party were frostbitten, and all suffered from the cold.

At the end of May another party, consisting of Messrs. Finch, G. Bruce, and a Gurkha, made a second attempt, and with the use of oxygen succeeded in reaching 27,300 ft. This climb was most arduous. At 25,500 ft. the party was stormbound for a night and a day. On the second night the climbers had a poor sleep, inhaling a quarter ration of oxygen. At 26,000 ft. the Gurkha became exhausted and had to return. This allowed more oxygen for Messrs. Finch and G. Bruce, who continued alone, but it increased each load from 36 lb. to 48 lb. Within a few feet of the summit ridge which represents the last lap they were forced to turn back. A long detour entailing slow progress was necessary in order to reach the ridge, and for this they had no food supplies. An unforeseen disadvantage of the use of oxygen was found to be the hunger it induced, and in consequence the difficulty in carrying sufficient food. When the climbers returned the same day to Camp III, after a meal on the way at Camp IV, " we were finished : I doubt " (writes Mr. Finch) " if either of us could have taken another step." This climb fell short of the summit by 1,700 ft., but it was a magnificent achievement, and was to prove the culmination of the season's work.

By the beginning of June the prospects of success were still bright, for the monsoon was not expected to break for a week or two. Three of the climbers were out of action owing to severe frostbite or fatigue, but five were ready and apparently fit for another attempt. On June 3 a start was made from the base up the East Rongbuk glacier along the line of camps. Ill-luck dogged the party from the beginning. On the day of their departure the monsoon broke with a thirty-six hours' snowstorm. At Camp I Mr. Finch was forced to admit that he had not recovered from his last great effort, and fell out. Messrs. Mallory, Somervell, Wakefield, and Crawford continued, reaching Camp III on June 5. They rested for a day, enjoying superb weather, and set out for Chang La on June 6. The lower slopes of the col were in good condition with a firm snow surface, and the out-

[1] *Mount Everest : the Reconnaissance*, 1921. Lieut.-Col. Howard-Bury, D.S.O., and others. London, 1922.

look seemed promising. Messrs. Mallory, Somervell, Crawford, and one porter were leading, all roped. Farther down, on three ropes, there followed fourteen porters laden with food and the oxygen apparatus. The climbers were about half-way up the north col, at a relatively gentle slope, when suddenly the snow began to slip. The leading party was carried down about 150 ft. before the slide was checked. All four extricated themselves unhurt. But disaster had befallen the porters lower down, who were caught n the main slip. Two rope-loads had been swept over a 60-ft. ice cliff into a crevasse, on the edge of which the third rope-load had providentially stopped. There was little hope of any rescue, but two men were dug out alive and one was found unhurt, though dazed, on the surface. After some hours six bodies were recovered, but a seventh could not be found. This disaster ended the third and last attempt to reach the summit of Mount Everest. Gen. Bruce pays a high tribute to the capacity and cheerfulness of the porters. "It is terrible to think that no fewer than seven splendid porters lost their lives in this tragedy. . . . . The work done by the porters was prodigious and unparalleled." The glacier camps were evacuated without further delay, and the whole expedition returned to India.



MAP OF MOUNT EVEREST AND THE SURROUNDING DISTRICT.
Reproduced by kind permission of the Royal Geographical Society.

The effort which an attempt on the summit of Mount Everest demands is very formidable, far more formidable than the relatively brief telegraphic despatches in the Press have suggested. Yet it should be noted that Gen. Bruce and the other members of the expedition have expressed the belief that experience has given them greater hopes of succeeding than many of them had before. The work of climbing at high altitudes must be reserved for young men who must at the same time have knowledge of snow conditions. Experience has shown that nights can be passed at 25,500 ft. without oxygen, and an altitude of 26,800 ft. was reached without its use. This discovery was unexpected, since the experiments in a pressure chamber in England had indicated 23,000 ft. as the altitude above which oxygen would always be required. It was also found that even at great heights climbers who are deprived of the use of oxygen, whether by accident or exhaustion of supply, do not suffer any great harm. Mr. Finch, however,

comments on a curious phenomenon in this respect. When he cut off his oxygen, at over 27,000 ft., he found himself suffering from a lack of decision. He hesitated in the choice of hand and foot holds in a strange way. On turning on the oxygen he became normal at once. Oxygen increases the climber's speed, but seems to result in greater exhaustion afterwards.

Fatigue is a serious obstacle. It is clear that a climber, however fit he may be, who exerts himself in gaining a great height is not likely to be of use for another great effort for some time. In view of the shortness of the climbing season, this means that there is no certainty that a climber can be relied on for two great efforts in one season's work.

The weather conditions seem to provide the greatest obstacle. The strong winds and the great cold are very trying. Even at Camp III, at 21,000 ft., the warmest night had a temperature only one degree above zero Fahrenheit: on one occasion a temperature of — 29° F. was recorded. This means the certainty of some casualties through frostbite. There are probably only some four or five weeks, just before the break of the monsoon, when the climb can be undertaken. For its successful accomplishment four consecutive fine days are necessary. Such conditions would appear to be very rare. This year's expedition never had more than two continuous days of fine weather.

The surface difficulties of the mountain did not prove greater than were anticipated, but the 1,700 ft. that remain to be covered appear to present some big obstacles. Mr. Finch wrote (*The Times*, July 18) as follows: "From the highest point reached on the mountain an excellent close-up view of the final ridge leading to the summit was obtained. The opinion was formed that though this final ridge is almost certainly climbable, it contains two severe obstacles in the nature of steep steps, the ascent of which entails not only difficult and steep rock climbing, but also very probably a considerable amount of step-cutting at altitudes above 28,000 ft."

We are glad to learn that, in spite of all difficulties, another attempt to reach the summit is to be made next year. It is to be hoped that this spirited adventure will be crowned with the success it merits.

DISEASE AND PERSONALITY

Encephalitis Lethargica, or Sleepy Sickness, has again been brought to the public notice by the appearance of the Ministry of Health's report on this subject. The striking drowsiness to which it owes its name is an example of how the nervous system reacts consistently to the disease attacking it. In one form a patient is emotional and cheerful; a patient with palsy is melancholic; while the general paralytic is overwhelmed with pride and self-importance. Some remarkable examples of this principle have been related by Dr. Head—cases in which, after the isolation by wound or disease of

[*Continued at foot of p.* 308.

The Antiquity of Man in America—II

By E. N. Fallaize, B.A.

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(*Continued from October No., p.* 268)

WHEN we turn to South America, the question of the antiquity of man assumes a very different aspect. In North America, finds are few and scattered, and geological data are either absent, or meagre, or fail to carry conviction; in the southern half of the continent the geological evidence is at first sight more full, though also far from satisfactory; but finds attributed to early man in the form of skeletal remains, stone implements, pottery, and the like, have been brought to light, literally, in thousands. The distribution of these finds has also played a part in the elaboration of theory. With the exception of human remains, assigned by some to the Quaternary Age, from the cave of Lagoa Santa in the province of Minaes Geraes in Brazil, and some skulls from the Rio Negro, Patagonia, the evidence in question is all derived from Argentina and, for the most part, from the province of Buenos Aires, which has, therefore, been regarded as the place of origin of man in South America. The remains which constitute this evidence were found in the loess-like formation[1] known as Pampæan which overlies the crystalline rocks of the continental surface. The stratification of the loess indicates an alternation of aridity and humidity which corresponds in a general way with the variations in the extension of the ice cap in the northern part of the continent during the Ice Age. The Upper and Middle Pampæan are assigned to the Quaternary, the Lower to the Tertiary Age. It must, however, be said that there is a serious difference of opinion as to the relative chronology of some of the geological strata: some, which one school would assign to early Tertiary times, being regarded by others as "recent."

It would be impossible to deal here in any detail with these data. For nearly forty years they were studied by the late Señor F. Ameghino, who, as each fresh discovery was made, added to his theory of Early Man until he had elaborated a complete exposition of his line of descent and place of origin. It will be sufficient to mention here the principal finds upon which this theory was based.

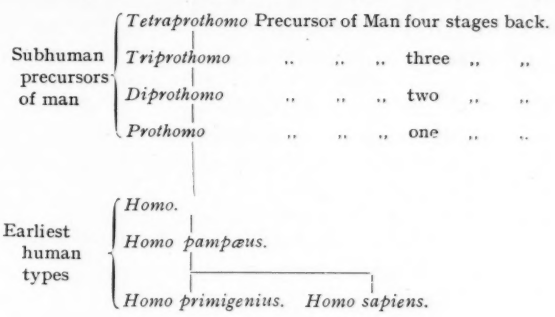
[1] This loess formation is composed of aluminous clay, siliceous sand, and oxide of iron, the result of the process of denudation of the upper watersheds, gathered, brought down, and distributed by rivers. The muds thus deposited, when dried, have been subjected to prolonged wind-sifting and have become uniformly fine in texture.

Mention has already been made of the human remains from the cave of Lagoa Santa, found in the earlier part of the last century, which, on the strength of their association with the bones of extinct mammals, were assigned to the Quaternary period. Ameghino himself was the first to announce the discovery of fossil man of Quaternary age in Argentina at Arroyo de Frias in 1872 and 1874. Other finds made by Santiago Roth followed at Saladero and Fontezuelas. Another find of importance was the Arrecifes Skull, found by an employee of the Museo Nacional of Argentina and regarded as of Lower Quaternary age. Among remains of the Pampæan type from Ovejero, Ameghino found evidence for a dwarf race of not more than 1·30 metres (4 ft.) in height.

The first claim for the existence of Tertiary Man was put forward by Roth, who discovered the Baradero skeleton in 1887. Later investigation failed to substantiate the Tertiary date assigned to the strata in which it was found. Ameghino subsequently described a number of skeletal remains which he assigned to the Tertiary period. Of these, the more important are the Arroyo Siasgo skeleton, which, on the ground of certain morphological peculiarities of the cranium, he decided to be an extinct species to which he gave the name *Homo caputinclinatus* (or Head bent down), and the Arroyo del Moro find—still another species to which he gave the name *Homo sinemento* (or Chinless man). That which Ameghino claimed to be the most primitive of all, and to which he gave the name *Homo pampæus*, was the specimen, discovered in 1888, known as the La Tigra or Miramar Skull. Later, he identified other examples of *Homo pampæus*, notably some skulls and other remains found at Necochea.

Not only was the Ameghino convinced that he had discovered the absolutely primitive type of man, but he also held that he had found the precursor of man. A skull, or rather the fragment of a skull, found in the course of digging a dock at Buenos Aires he maintained belonged to a species of subhuman type, to which he gave the name of *Diprothomo platensis*, belonging to the earliest phase of the Pliocene Age (the fourth period of the Tertiary), while in an atlas [1] and femur (thigh-bone) which he argued came from the Upper Miocene —the third period of the Tertiary—he saw the remains of *Tetraprothomo argentinus*. Although no skeletal remains of an earlier date were found, he deduced the existence of earlier types from the evidence of burnt earth, which he maintained could not be due to natural causes, not only in the Oligocene, but also in the Eocene, the two earliest phases of the Tertiary period.

Upon this evidence Ameghino based a scheme of the descent of man which can most conveniently be exhibited as follows :


Subhuman precursors of man
Tetraprothomo Precursor of Man four stages back.
Triprothomo .. .. .. three .. ..
Diprothomo .. .. .. two .. ..
Prothomo .. .. .. one .. ..
Earliest human types
Homo.
Homo pampæus.
Homo primigenius.
Homo sapiens.

From this the conclusion followed that man originated in America, and, owing to the number of finds in Argentina, Ameghino held that this was his place of origin.

It must not be imagined that these views were uncriticised. From time to time a majority of prominent anthropologists pointed out weaknesses in his arguments. In the case of the fragment of the skull of *Diprothomo*, it was shown that his failure to follow correct anthropological method in orienting [2] the skull had led to a complete misunderstanding of its character. An exhaustive examination of the evidence was made by Dr. Aleš Hrdlička and Dr. Bailey Willis, the geologist, of Washington, who visited a number of the sites of the discoveries and made a thorough examination of the terrain. Dr. Hrdlička also examined and measured all the human remains accessible to him. Dr. Willis's conclusion was that in no case was there any evidence for the geological antiquity of man. In some cases he was not convinced that the geological strata were anything more than "recent," while in other cases, where the strata belonged to the Quaternary or, possibly, the Tertiary epoch, there was every reason to believe that the skeletal remains had been deposited there by interment, or by intrusion through the agency of natural forces at a time subsequent to the original deposition of the strata. In many cases the geological evidence depended upon hearsay, or had been incorrectly recorded, or had not been recorded at all. Formations had been described as Tertiary or early Quaternary, which a more extended knowledge of geology would have shown to be recent. As was shown by subsequent analysis and experiment, the *tierra cocida*, or burnt earth, which was regarded as evidence for the

[1] The first cervical vertebra on which the head is balanced.

[2] Orientation is a technical term applied to the method of fixing a skull or fragment of a skull at a certain angle according to rule before any anthropometric observations are made. This ensures that measurements of different skulls are accurately comparable.

existence of man in Oligocene and Eocene times, required a far greater degree of heat for its production than could be attained by ordinary agency, and was probably due to volcanic action.

The results of Dr. Hrdlička's anthropological investigations entirely agreed with this view of the geological evidence, and in no case did he find that the skeletal remains were of a type differing markedly from that of the American Indian. Evidence upon which Ameghino had relied was due either to faulty methods, faulty observation, or faulty deduction. In a number of cases he pointed out that deformation of the skull, either posthumous or else artificial, such as was practised by the Aymara Indians, had been misunderstood by Ameghino and had led him to an entirely wrong conclusion as to the character of his specimens.

The masterly analysis of the evidence by these two eminent scientists, who were not merely impartial, but were, if anything, anxious to be convinced, has not been seriously questioned, and it may be regarded as conclusively settled that no greater antiquity can be claimed for man in the south of the American continent than in the north. Lest, however, it should be thought that the conclusions of Ameghino and those of his school were too lightly put forward, it may be pointed out that so distinguished a scientist as Dr. Bowman, the geologist of the Yale expedition to Peru, was convinced that he had discovered indubitable evidence which warranted him in attributing an antiquity of anything between 10,000 and 75,000 years to human skeletal remains discovered at Cuzco —a view which was only retracted after a careful re-examination of the evidence on the spot by Prof. Hiram Bingham.

Notwithstanding the unsatisfactory conclusion which inevitably results from a careful examination of the evidence adduced for the antiquity of man in America, it is not without profit that it should be reviewed. It serves as a warning that any fresh piece of evidence, which at first sight seems to warrant the attribution of a high antiquity to human remains found in America, must be received with extreme caution, and very carefully weighed before it can be accepted. In the case of the recently discovered tooth from the Upper Pliocene beds of Nebraska to which reference was made at the beginning of this note, where, so far as our information goes at present, the geological evidence is beyond dispute, its identification as a relic of a precursor of man will need most careful scrutiny and, as a matter of fact, it has already been called in question. It this connection, it must be remembered that no traces of the great ape type have hitherto been discovered in America—a fact which in itself must needs give rise to some hesitation before discarding previous conclusions as to the relatively modern appearance of the human stock on that continent.

(*Concluded*)

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Eclipses of the Sun

By H. Spencer Toy, B.Sc., A.Inst.P., F.R.A.S.

ECLIPSES of the sun may be divided into three classes —partial, annular, and total.

In the first, the moon does not come directly between us and the sun, but passes a little on one side of the central line and so obscures only a part of the solar disc. In the second, the annular form, the moon is on the central line, but appears to be too small to hide the whole of the surface of the sun, so that even when it is projected entirely against it at the maximum phase, it is still surrounded by a ring of light. In the case of the total eclipse, however, the sun completely disappears behind the moon.

It is a curious and fortunate coincidence that the apparent sizes of the sun and moon are so nearly the same. The diameter of the sun is nearly four hundred times greater than that of our satellite, but its distance is also almost four hundred times greater, so that when looked at from the earth one body appears to be as large as the other. To these circumstances we owe our ability to see both the annular and the total form of eclipse, for as the sun and moon run through the small changes in their respective distances from the earth, so their apparent sizes vary somewhat and give one of them a slight preponderance over the other.

The geometrical conditions of an eclipse of the sun are shown in Fig. 1 (for clearness it is not drawn to scale), which shows the moon, M, between the earth and sun, S, throwing its shadow towards some part of the

earth and eclipsing the sun. The dark conical region is that within which the sun is entirely hidden from sight. This portion of the shadow is called the *umbra*. Around the umbra is an enveloping cone, shown shaded in Fig. 1, with its vertices directed towards the sun, the *penumbra*. To an observer within this region the sun is partly hidden from view. As the apparent path of the moon may pass from the north or south of the line joining the earth and sun, the axis of its shadow may pass from the north or south of the earth and may not meet it at all. An eclipse of the sun is called *central* when the shadow axis strikes any part of the earth; *partial* when only the penumbra falls upon the earth. It is evident that an eclipse can be seen as central only at those points of the earth's surface over which the axis of the shadow passes. An eclipse is total when the umbra actually reaches the earth; annular when it does not. These two cases are shown in Figs. 2 and 3. In Fig. 2 the shaded portion represents the shadow of the moon striking the earth; the sun is entirely hidden within the region *pp*. In Fig. 3 within the region *qq* it is seen that a part of the sun can be seen even when the moon is between it and the earth. In this case at the moment of greatest eclipse a narrow ring of sunlight is seen surrounding the dark body of the moon.

Eclipses fall naturally into groups or series, each of which Professor Turner calls a "family." The movements of the earth and moon with respect to each other and to the sun are such that after about eighteen years and ten and one-third days the three bodies come back almost to the same relative positions, so that after this interval an eclipse merely repeats itself, and continues to do so every succeeding eighteen years. Any distinguishing feature of one eclipse, as, for instance, an unusually long duration, recurs in all the rest, and so is a characteristic of the whole family. This period was known to the ancients and called by them the Saros.

The eighteen years and ten days that constitute the Saros imply that the period contains five leap years. If it contains only four, then the extra odd days will, of course, be eleven, and if the period includes only three leap years—as, for example, from 1897 to 1915 (1900 was not a leap year)—then the odd days will be twelve. This point is not always stated clearly, with the result that there is not a little popular confusion about the additional days.

The different families are distinguished on maps by the tracks they trace out on the earth. In order to be definite in speaking of the tracks, we will confine our attention to the eclipses in which totality occurs. The track of one eclipse does not fall on the same part of the earth as did the previous one, for the odd fraction, viz. one-third, of a day in the Saros causes it to shift one-third of the way round the globe. It follows, therefore, that the fourth of such tracks will have shifted three-thirds, or the whole, way round. Similarly, the seventh will have gone round twice, so that the first, fourth, seventh, etc., will all lie in the same part of the earth, the interval between them being a little more than fifty-four years. But although these lie in the same part of the earth, yet it is found that the fourth does not cover precisely the same line as the first; it has moved a little to the north or south, as the case may be. The seventh has moved a little farther still, and so they go on until one of the Poles is reached. When this happens, the family leaves the earth entirely and so becomes extinct.

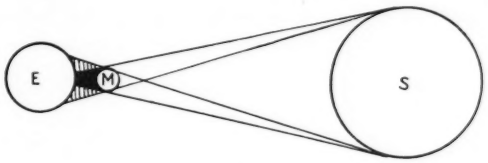

FIG. 1.

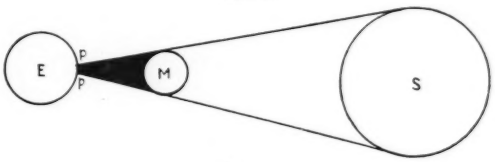

FIG. 2.

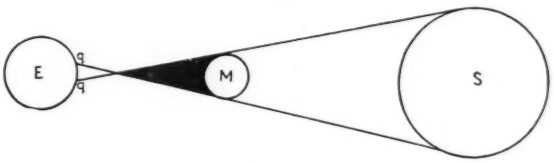

FIG. 3.

The life-history of a family extends over something like 1,260 years. The first member comes into existence when its penumbra first grazes the earth not far from one of the Poles. Then there follow a dozen partial eclipses, each larger than its predecessor. By this time the central line has come in at the Pole and we have a series of forty or fifty total or annular eclipses. About eighteen of them will be total and twenty-seven annular, the ratio of total to annular being approximately two to three. In the middle of the series the central line strikes the earth near the equator; it continues to progress in the direction in which it has already been travelling, and leaves the earth near the Pole opposite to that near which it entered. Then come another dozen partial eclipses, and the family becomes extinct. (It must be stated that the numbers given in this paragraph are only approximate.)

Chambers traces one such family. It began at the

North Pole in June 1295. On August 27, 1367, it made its first appearance in the north of Europe; in 1439 it was visible all over Europe; in 1601, its eighteenth appearance, it was central and annular in England. It appeared again in June 1908, and will return in July 1926. At its thirty-ninth appearance, the shadow track will have passed the Equator. The family continues to travel south, and finally it will disappear in 2665.

There are twelve families of total eclipse tracks in existence at any one time. Six of them are moving north, and six moving south. When one family goes out at one Pole another comes in at the other, and thus their number is kept constant.

The next new family will come in at the South Pole on May 29, 1938. The series of particular importance to Britishers, however, is that which contains

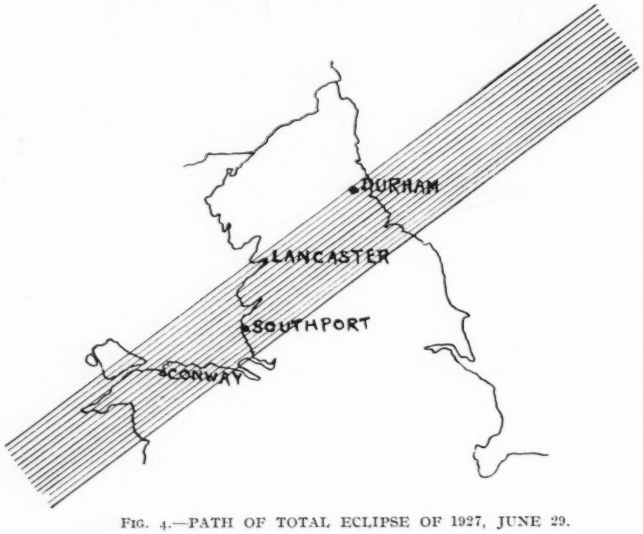

FIG. 4.—PATH OF TOTAL ECLIPSE OF 1927, JUNE 29.

the eclipse of 1927, for in that year the track will cross the north of England. The eclipse will take place on June 29, and will be total along a band including Conway, Liverpool, Southport, Lancaster, Ripon, and Durham, the central line running from St. David's Head to a point between Whitby and Hartlepool. It will be the first one visible as such in the British Isles since May 22, 1724, an interval of more than two hundred years.

The path just described will be traced out in the morning; so will be the beginning of the track, which will pass on to Scandinavia and Northern Asia. At its fourth subsequent return, that of 1981, the beginning will be displaced sufficiently to miss the British Isles, but at the following return, on August 11, 1999, the middle section of the track will just graze the extreme west of Cornwall.

Since there are only twelve families of total eclipses, and each recurs but once in eighteen years, it follows that a total eclipse cannot take place annually. The way in which eclipses do actually occur will be seen from the following list, which covers the eighteen years, and so includes one member of each family. The maximum duration of each is given.

Date.	Duration.	Where Visible.
	mins.	
1922 Sept. 21	6·1	East Africa, Australia.
1923 Sept. 10	3·6	California, Mexico, Central America.
1925 Jan. 24	2·4	United States.
1926 Jan. 14	4·2	East Africa to Philippines.
1927 June 29	0·7	England, Scandinavia.
1929 May 9	5·1	Sumatra, Philippines.
1930 Oct. 21	1·9	Pacific Ocean, Patagonia.
1932 Aug. 31	1·5	Canada, East United States.
1934 Feb. 14	2·7	Borneo, Celebes.
1936 June 19	2·5	Greece to Central Asia.
1937 June 8	7·1	Pacific Ocean to Peru.
1938 May 29	4·0	South Pole (already referred to; new family).
1940 Oct. 1	5·7	Colombia, Brazil, South Africa.

The approximate date of the next member of any family may be obtained by adding eighteen years.

The series which includes 1937 is remarkable for the long duration of total eclipse. Those of 1937 and 1955 will fall not more than 20 secs. short of the absolute maximum of 7 mins. 30 secs. But the 1934 series will increase to even greater duration, reaching in 2150, June 25, a length of about 7 mins. 16 secs., and in 2168, July 5, a length of 7 mins. 28 secs., the longest hitherto known in historical times. The former will pass over the Pacific Ocean, the second over the southern part of India near Madras.

It will be noticed that both these eclipses occur near midsummer. As a general rule, a summer eclipse is likely to be of longer duration than one which takes place in the winter, for in the summer the earth is at its maximum distance from the sun, so that the latter appears to be of minimum size, and can therefore be concealed by the moon for the greater time.

The Saros is, of course, the most important period of eclipse recurrence, and is the governing factor of the "families." There is, however, another important period. This contains 10,571·95 days, about 20·3 days less than twenty-nine years. But in this period the eclipse may vary from total to annular. Thus the annular eclipse of February 14, 1915, will be followed by a total eclipse on January 25, 1944; that total on April 16, 1893, was followed by the recent annular on March 27, 1922; but the total eclipse of May 28, 1900, will be succeeded by a total eclipse again on May 9, 1929.

It might sometimes happen that even the same

eclipse would be both annular and total, the former in one part of its track, the latter in another. This is a very rare phenomenon, and is due to a slight variation in the moon's distance from the earth during the progress of the eclipse, the earth being all the time close to the apex of the lunar shadow. Or if the earth were actually at the apex, the shadow would just exactly reach it, with the result that a total eclipse would be observed at the moment when a perpendicular upward view could be obtained, but this would be preceded and followed by some minutes of the annular phase. One such eclipse took place on December 12, 1890 (see Fig. 5).

An interesting series in the twenty-nine-year period is that containing the historical eclipse of Nineveh, which was visible in the year 763 B.C. on June 15. This is recorded in the Assyrian tablets. Adding the period we are considering, we find other eclipses on May 27, 734 B.C., May 7, 705 B.C., a series continuing

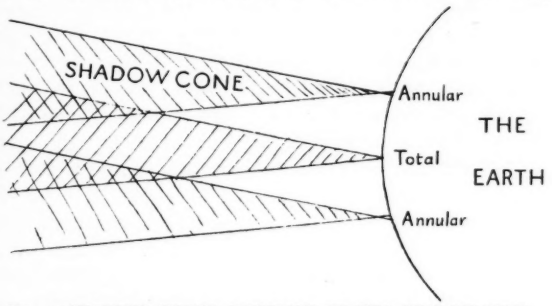

FIG. 5.—SHOWING THREE POSITIONS OF THE SHADOW-CONE.

to our own times in the eclipses of 1814, July 17 (total); 1843, June 27 (annular); 1872, June 6 (annular); 1901, May 18 (total); the last-mentioned being the ninety-third of the series since that of Nineveh. Between each of these eclipses the lunar perigee—that point in the moon's orbit at which it is nearest to the earth—moves through about 242·4 degrees, so that after three such intervals it has advanced through 727 degrees, and, since 720 degrees is twice round the circle, it is thus only 7 degrees in advance of its original position. For a long period of, say, a thousand years or more, every third eclipse of the series—i.e. every one recurring at 3×29, i.e. 87 years—will therefore be of the same character. Thus those of 1814, 1901, 1988, in the above series are total.

The dates mentioned above involve a change from the so-called Old Style to the New. The latter was introduced in 1582, and the formula for conversion from one to the other can be set out in a word or two. To get the New Style from the Old, if the year under consideration comes anywhere—

From 1582 to 1699 add 10 days.
,, 1700 ,, 1799 ,, 11 ,,
From 1800 to 1899 add 12 days
,, 1900 ,, 2099 ,, 13 ,,

Similarly, to change from the New Style to the Old, the days must be subtracted.

If a longer view be taken of this twenty-nine-year period, it will be noticed that when it is multiplied by eighteen, the few days short of twenty-nine years amount to practically a whole year, the result being that eighteen times the period is almost exactly 521 years. The consequence of this is that after this lapse of time the eclipses recur on the same day of the year. Thus if we take the Nineveh eclipse of 763 and add 521 a number of times, we get the years 242 B.C., 280, 801, 1322, and 1843 A.D. In each of these years, therefore, the eclipse took place on June 15, Old Style, or, using the above formula for 1843, on June 27 in that year, a result agreeing with that already given.

Reference has been made earlier in this article to the eclipse of 1927, June 29, the first to be total in Britain for more than 200 years. If we subtract twice 521 years, i.e. 1,042 years, and convert from New to Old Style we find that its predecessor occurred in 885, June 16. This was total in Scotland, its track being shown by Maguire in the *Monthly Notices* of the Royal Astronomical Society (vol. xlv) to run from S.W. to N.E., thus being practically parallel to that of 1927.

Since total eclipses are not very frequent, and when they do occur are seen as such only from a narrow strip on the earth, it will be realised at once that they are very uncommon in any locality, especially in any particular town. Six only have touched any part of the British Isles for the last five hundred years, the dates being:

1424	June 26	1652	April 8
1433	June 17	1715	May 2
1598	Mar. 6	1724	May 22

If we extend this list backwards for another thousand years, we find eleven more total eclipses visible in the British Isles:

594	July 23	1023	Jan. 24
603	Aug. 12	1133	Aug. 1 (C)
639	Sept. 3	1140	Mar. 20 (C)
664	May 1 (C)	1185	May 1 (C)
878	Oct. 29 (C)	1330	July 16
885	June 15		

"C" indicates a reference in the Anglo-Saxon Chronicles. The eclipses have included London twice, Dublin twice, and Edinburgh five times. Of the seventeen in the list, that of 885 was of the longest duration, lasting in England for 4 mins. 55 secs.,

whilst that of 1330 was the shortest, lasting 4 secs. short of a minute.

An interesting point in connection with eclipses, both lunar and solar, is the times at which they occur in any particular year. These are grouped into two chief divisions, separated by about six months, and known as the "Eclipse Seasons." Eclipses can occur only when the sun is near a node,[1] and this happens only twice in the year. Hence we have the general rule that in any year there are two dominant eclipses separated by about six months, whilst others may occur a fortnight before or a fortnight after them.

This might seem to imply that the eclipse seasons

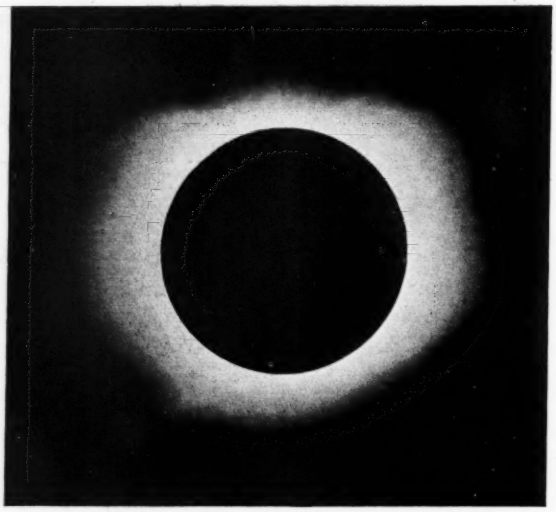

FIG. 6.—TOTAL ECLIPSE OF 1914, SHOWING CORONA.
Reproduced, by permission, from the "Monthly Notices" of the Royal Astronomical Society.

are in the same months year by year, an implication contrary to experience. The nodes are continually changing their positions, with the effect that the eclipse seasons come about eighteen or twenty days earlier in succeeding years. This can be seen if we tabulate the eclipses for a year or two.

Year.	Date.		Mean.
1921	April 8	Sun	April 15
	April 22	Moon	
	Oct. 1	Sun	Oct. 8
	Oct. 16	Moon	
1922	Mar. 28	Sun	
	Sept. 20	Sun	
1923	Mar. 3	Moon	Mar. 10
	Mar. 17	Sun	
	Aug. 26	Moon	Sept. 3
	Sept. 10	Sun	

The maximum number of eclipses that can occur near any one mean date is three; there cannot normally be more than six in a year, a number not often reached. Occasionally, however, there may be seven, but only if the eclipse seasons come either in January and July, when there may be overlapping from the succeeding year, or in June and December, when there may just come in an extra one from the previous year.

This greatest possible number, seven, was reached in 1917, and will be reached again in 1935. It was reached once in the nineteenth century. According to civil time, 1805 had seven, but as the first occurred at 1 a.m. on January 1, it would count as in 1804 according to astronomical reckoning, in which the day is regarded as beginning at noon. But as against this, 1823 had six according to the civil reckoning, and seven according to the astronomical, the last occurring at 8 o'clock on the morning of New Year's Day 1824, a time astronomers would call 20 o'clock on December 31, 1823. We may, therefore, count either 1805 or 1823 as having had seven eclipses, according to the system we adopt, but we cannot fairly count both.

It may be mentioned in passing that this dual system of reckoning is to terminate at the end of 1924. The astronomical New Year's Day of 1925 will commence at midnight, and thus conform to civil time.

There seems to be no period of years which will bring round the recurrence of seven eclipses with certainty. There is a tendency to 112, as, for example, from 1805 to 1917. Adding another 112 years we have 2029, which misses the seven only by a few hours. Then, of course, the Saros might sometimes apply, as from 1917 to 1935, but we cannot state this with accuracy as being generally true.

The eclipse season also determines the direction of the path of the total eclipse upon the earth. In March it runs from S.W. to N.E., and in September from N.W. to S.E. In June the track is a curve, running first to the N.E. and then bending round to S.E., and in December it runs S.E. first and bends round to the N.E. In intermediate months we have a compromise between these extremes.

[1] The "nodes" are the points in which the orbit of the moon cuts the plane of the ecliptic, or the orbit of the earth.

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In 1887 Oppolzer published at Vienna his monumental work entitled *Canon der Finsternisse* (Canon of Eclipses), which contains the approximate elements of all eclipses (8,000 solar and 5,200 lunar) between 1207 B.C. and A.D. 2162, with charts for all annular and total eclipses of the sun.

In vol. xlv of the *Monthly Notices of the Royal Astronomical Society*, Maguire has an article on the total eclipses in the British Isles, together with a map.

Most textbooks on astronomy contain much information on this subject, the article on "Eclipses" in the *Encyclopædia Britannica* being particularly good.

An excellent popular account is given in Professor H. H. Turner's *A Voyage in Space* (S.P.C.K. 6*s*.).

The British Association's Meeting[1]

THE meeting at Hull this year was useful rather than distinguished. A mass of important subjects was described and discussed, some of which are of interest to many besides specialists. The presidential address by Sir Charles Sherrington, however, dealt with a subject that is difficult to describe to the layman, problems of the mechanism of vital processes, especially those of the nervous system, and can be followed in detail by physiologists only. There is a considerable number of amateur scientists who bother publishers with their immature manuscripts on such problems as the origin of life, the relation of mind to matter, and kindred subjects, described or touched on in the presidential address ; it is good to know that, if they give the address the attention which it deserves, they will remain quiescent for a time and be the wiser at the finish. The philosopher, too, not yet recovered from the fatigue of absorbing the theory of Einstein (which, fortunately, by the way, was given a rest this year), has now got a further problem to engage his attention. And physiologists themselves are divided with respect to a conclusion on which the president laid great insistence, namely, that biology must in ultimate analysis be nothing but physics and chemistry. The address, therefore, has the merit of stimulating discussion among those who can understand it. It is this setting men thinking and talking on a really important problem, that is only partly solved, which helps so much towards a complete or at least a provisional solution of it. Some notes are given below of a few of the subjects discussed. Several of the topics, like those on agriculture or on economics, do not come within our range. Others, like those on the migration of the eel, the fixation of atmospheric nitrogen, Wegener's theory of the origin of the continents, and the atoms of matter, have been discussed in articles in earlier issues of this journal.

MENTAL CHARACTERISTICS AND RACE

This subject was discussed at a joint meeting of the Anthropology and Psychology Sections. Professor J. L. Myres said that mental qualities were inherited just as physical characters were, and therefore it might be assumed they stood in some direct relation with some element in the nervous system. Some mental qualities appeared to be associated with physical characteristics, for instance, fiery temper and red hair. The novelist had long made use of such associations, and everybody knew what was expected of a hero with steel-blue eyes or a horse-face. Professor Myres described how it was possible to some extent to enhance and combine mental qualities in certain domestic animals. In illustration he spoke of the recent establishment of the Rhodesian lion-hound, which was bred with strength and courage to attack, great speed, and tenacity to hold on. Individuals did not always exhibit, however, the characteristics expected of them. There were gun-shy pointers, for example, and even gun-shy men in military families.

Dr. C. S. Myers said that the two chief influences on mental character were heredity and environment. Sunshine, humidity, earthquakes, food-supply—all these had an important influence on the mental character of a race. Physical appearances were sometimes misleading. There might be handsome boys and girls in a family of deficients. The explanation of that was that they had been given a false start, which had interfered with the growth of their minds, but not with their bodies. An accident in infancy might interfere with development and make a man, who would otherwise have been brave, gun-shy. It was interesting to see how different countries were developing different human types. It was now possible, for instance, to distinguish the New Zealander from the Australian. How these types came about was not known, nor was it known how long they might persist. Even different parts of a country showed marked characteristics. In our own country Yorkshire and Welsh people were musical. Another interesting fact was that a characteristic might appear for a time and then disappear. England in Elizabeth's day was pre-eminent in music ; at various times other countries had been pre-eminent in different branches of art.

Mr. E. N. Fallaize quoted from two writers in the time of King Henry VIII to show how little had been the change in national characteristics. The first writer, a Scot, described the Frenchman as volatile, the German as wily, and the Englishman as full of pride and with a great deal of self-satisfaction. The second, the Venetian Ambassador in London, described the English as hospitable and generous, and said that if an English working-man met in the street a friend who was starving he would not give him a slice of bread, but would say, " Come and have a drink."

THE AGE AND AREA THEORY

One of the chief subjects discussed at a joint meeting of the Zoology and Botany Sections was a statistical theory of the geographical distribution of plants and animals recently published by Dr. J. C. Willis in a book entitled *Age and Area*. Dr. Willis, in opening, said that Darwin's great contribution to science was the establishment of evolution as the

[1] *The Advancement of Science :* 1922 (John Murray, 6s.). *Nature*, September 9 and 16. Reports in *The Times*, September 9–14.

mode in which animals and plants had come into existence, but he held that his special theory of natural selection was now disproved and worthless. For some reason the plant has advantages which enable it to spread. His theory explained the present distribution of plants and animals on a mechanical principle so well that it could be applied successfully to predicting unknown cases. His reason for it was that he found that the area occupied by species varied with their age, new species occupying very small areas, and older species having a wider distribution. Moreover, older genera had a larger number of species than younger genera. The theory explained evolution and the spread of animals and plants as strictly mechanical processes depending in no way on natural selection.

This new theory was opposed by several important speakers, who pointed out that the actual facts of the distribution of plants did not agree with those predicted by the theory. The general opinion was that no problem in biology could be determined by statistics, for these were merely "smoothed abstractions of actual facts." Observation and experiment were the avenues to understand living things, and the more patiently these were pursued in the spirit of Darwin, the more they appeared to confirm the main lines of his work.

CRITICISM OF M. COUÉ'S METHOD

A second piece of work that was adversely criticised was the Coué method, which has recently created great stir in the land. Dr. W. Brown dealt with it incidentally in a paper to the Psychology Section on auto-suggestion. M. Coué has an extraordinarily clear and penetrating insight into the facts of suggestion, transparent sincerity, and untiring zeal. But he is not a doctor, so that in a sense he is an amateur. And medical men specialising in neurology and psycho-therapy have employed similar methods of treatment on suitable patients with success in no way inferior to that claimed for his work. Their more profound knowledge of the facts of physical and mental disease has allowed them to make progress in psycho-therapy which leaves the amateur far behind. Auto-suggestion, or the patient's appeal to his own subconscious mind, must always be supplemented—and sometimes so extensively as to be replaced—by knowledge of many of the chief motive-forces actuating that subconscious. Dr. Brown said it was quite unnecessary to repeat a parrot-phrase twenty times. (A later speaker said that such repetition in curing a headache had brought on sore throat!) He also gave an account of his own methods of treatment by suggestion and auto-suggestion (which are described in his recent book *Suggestion and Mental Analysis*), and told how children, who could not concentrate their minds, responded to it. For example, a little girl of thirteen, who was very bad at writing essays, was treated by him, and after eight hours' treatment was able to do her essay-writing properly and well.

PROBLEMS IN THE THEORY OF NUMBER

The presidential address to Section A (Mathematics and Physics) was given this year by Mr. G. H. Hardy, the Professor of Mathematics at Oxford. He propounded five problems in the theory of numbers which are yet to be solved, three of which are of general interest. The first is: *When is a number the sum of two cubes, and in how many ways may it be so expressed?* The numbers 2 and 9 are sums of two cubes, the former being equal to $1^3 + 1^3$, the latter to $2^3 + 1^3$; 3 and 4 are not. It is exceptional for a number to be the sum of two cubes, and such numbers become rarer and rarer as investigation extends to larger and larger numbers. No simple test has yet been discovered by which such numbers can be distinguished. Again, 2 and 9 are sums of two cubes and can be expressed in one way only, but there are numbers so expressible in a variety of ways. 1729 may be expressed in two ways, $12^3 + 1^3$ or $10^3 + 9^3$, and is the smallest number to be expressed in this way. This has been worked out mentally, but, when a number is sought which is the sum of two cubes expressible in three ways, the computer requires paper. The smallest number indeed is 175,959,000, which is $560^3 + 70^3$ or $552^3 + 198^3$ or $525^3 + 315^3$. There is one number known which may be expressible in four ways, 912,646,702,079,469,000, a number so huge that when we are told that no one has discovered a number which may be represented in more than four ways we do not feel altogether surprised. Theory, however, has run ahead of computation and has shown that numbers exist which may be expressed in five, six, or in any number of ways.

The second problem is also a difficult one: *Is every large number the sum of five cubes only?* It is known that every number without exception is the sum of nine cubes and two numbers, 23 (which is $2^3 + 2^3 + 1^3 + 1^3 + 1^3 + 1^3 + 1^3 + 1^3 + 1^3$) and 239 ($5^3 + 3^3 + 3^3 + 3^3 + 2^3 + 2^3 + 2^3 + 2^3 + 1^3$), cannot be expressed as a sum of less than nine. There are only fifteen, the largest being 454, which need eight, and one hundred and twenty-one, the largest being 8,042, which need seven. Numbers expressible as the sum of six cubes are probably all less than 1,000,000. Beyond this all numbers may probably be expressed as the sum of five, or, with very large numbers, of four, but the numbers are so large that computation is helpless. Numbers expressed as the sum of four

persist for ever, since there are certain forms of numbers which cannot be expressed in less.

The third problem is: *Is* $2^{137} - 1$ *a prime number*, that is to say a number without factors other than unity and itself? Part of the interest of this still unsolved problem lies in the fact that a certain mathematician, Mersenne, asserted in 1644 that the only values of the index n up to the number 257 for which $2^n - 1$ is prime are 2, 3, 5, 7, 13, 17, 19, 31, 67, 127, and 257. This assertion was believed to be true for many years, because there was no evidence to the contrary, and mathematicians wondered how Mersenne had arrived at this result. Had he discovered some formula which he kept to himself, and which later mathematicians had failed to rediscover? It was believed so, and an enormous amount of labour and of paper was expended in trying to verify this assertion. It has now been established that part of it is probably mere guesswork based on inadequate evidence and is wrong. 67 should have been left out; 61, 89, and 107 included. Mersenne may also have been wrong in omitting 137. It is now the least value of n, for which the answer is still in doubt. When written out $2^{137} - 1$ is a number of forty-two digits, so a computer setting out to verify if it be a prime number has a considerable task before him!

THE ORIGIN OF COAL SEAMS

The purport of Professor Kendall's presidential address to the Geology Section was to show that coal seams are the result of growth and accumulation of peat, on the spot, and that all the phenomena of the British coal measures can be explained upon this hypothesis. True, coal seams are characterised by certain definite facts. They are of wide extent, show uniformity of thickness and character over extensive areas, are very free from admixture with the accumulated matter resulting from the disintegration of rocks, and show no signs of aquatic animals within the seam. The inference is that in the main they are formed from old beds of peat in a lowland area which has undergone, in the course of geological time, intermittent depression such as would bring in at one time the muds and sands from flowing water and at another time even the sea. It is of interest to note that near at hand there is at the present day an area which corresponds closely to the areas in past ages from which the coal measures have been formed. This is the North Sea. At some period subsequent to the last ice age the whole of the British Isles appears to have stood relatively to the sea about 80 ft. above its present level. The North Sea was then a vast plain, so nearly at the sea level that it became a morass. Round its margins were forests of oak, pine, and birch, and the greater part of the area furnished the conditions for a great peat swamp. At the present day it is a huge bed of peat, throughout its length and breadth, as trawlers testify, and at its edges on the coasts of Holland and of England, as observations at favourable conditions of the tide show.

BREATHING AT HIGH ALTITUDES

Mr. J. Barcroft, F.R.S., an authority on respiration, and the leader of an expedition which has recently been out to the Andes to study the effect of the lack of oxygen on the human system, gave an account of his observations to the Physiological Section. His party made their observations in a mining village in Peru, 14,200 ft. above sea-level. At that altitude they were slightly out of breath, even when sitting down, and exertion like walking up hill made them pant. They found their brains worked much more slowly than at lower altitudes. The people who lived at these extreme altitudes, and consequently were acclimatised, were very short of stature, but had the chests of men of 5 ft. 11 in. Cows, they found, could give milk when living at 12,000 ft., but not at 13,000 ft. At 14,000 ft. they gradually died of lack of oxygen. At this elevation dogs, ponies, and sheep could live, but dogs not very happily. These experiments, like those conducted at other places of high elevation, such as in Tibet and on Pike's Peak, are throwing a flood of light on the subject of respiration which is of great practical interest to all those who venture to high elevations, whether on the ground or in the air.

A. S. RUSSELL.

Reviews of Books

COUNTRIES AND CLIMATES

The Climate of the Continents. By W. G. KENDREW, M.A. (Oxford: Clarendon Press, 21*s.*)

Mr. Kendrew differs from most of us in speaking and writing of the weather in no mean or narrow sense. We are dwellers in small places; Mr. Kendrew is a citizen of the terrestrial sphere. Our interest in climate is mainly personal, confined to the present or recent past, and to our immediate neighbourhood, and useful as an opening in polite conversation; Mr. Kendrew's is deep and abiding, not confined to country-side or country, but content with embracing nothing less important than what O. Henry called the terrestrial, globular, planetary hunk of matter, slightly flattened at the poles, known as the Earth.

Yet the subject is, or can be made, very interesting, because it touches us at many points, and its study need not prostrate us. We cannot always understand the

weather, but we can understand what is meant by it; we recognise its phenomena. No scientific subject needs less of the jargon or the conventions of science in being expounded than this one. Its effects come within either the experience or the imagination of us all; we can imagine an earthquake or a tornado or even a mosquito bite, and we are able to follow without further explanation that 105° in the shade of a moist country is quite definitely warm. But besides interest the weather possesses the gift of permanence. It changes with the seasons, but the seasons do not change, or at least they change little in the life-time of man. How few things accurately described a hundred years ago could be described in nearly identical terms to-day! Climate is one of the few.

It might be thought that a subject of such interest and such permanence must often have been described in books, but no. Mr. Kendrew's is the first description in English of the actual climate of the countries of the earth considered regionally. There are a few books in English which describe the climate of parts of the earth, and there are all-embracing tomes in German, but till now English geographers have hesitated in making a comprehensive compilation.

A work of this kind must be essentially a composition from such materials as statistics, more or less adequate, maps showing certain factors of climate, and regional descriptions; and the result must be largely dependent on the nature of the original sources. But Mr. Kendrew has done his work well. He has now given to the public an informed and interesting general account of the climate of the continents which may constitute a framework into which detailed local descriptions may be intelligently fitted. Behold, then, the author taking the great round world in his hand, so to speak, and beginning with Africa, gradually working round the globe; telling us of each country in turn, its changes of temperature, its rainfall, its prevailing winds, and all the things embraced by climate; illustrating his forty-eight chapters with a hundred and fifty illustrations; including many tables of statistics, and quoting at times many vivid descriptions of travellers of the weather at different parts of the earth. It is impossible not to be interested in his book.

We will quote first of all a description by Borius, included in the book, of a day in a very unpleasant climate, Senegambia, in the rainy season:

"Soon after sunrise the shade temperature is 80°. The calm air gets hotter and hotter, and by 9 a.m. it is unpleasant to walk about even with a sunshade. . . . At midday the thermometer is still rising, and by 1 p.m. it stands at 86°. . . . By 4 p.m. the temperature is 88°; the sky is three-fourths clouded, and masses of cloud are piling up on the horizon; the wind often drops altogether. The heat now feels excessive, and though after 4 p.m. the thermometer hardly rises a degree, yet the heat seems to be increasing considerably, and we are astonished that the thermometer does not show a greater rise. We perspire profusely on the slightest exertion. . . . We go in again, but the heat indoors is overwhelming and we long desperately for a breeze. There is no need for a hygrometer to show that the air is saturated with moisture. It is this high humidity that makes the heat so overpowering, although the actual temperature is not excessive.

"Nothing can be compared with the feeling of utter prostration that overcomes a European. Though he sits motionless in an arm-chair he perspires as after violent toil; his fatigue is not like what is felt after work, but rather a weakness in the limbs, and especially in the bones—an indescribable feeling of discomfort, which precludes all movement, all bodily or mental work, but yet forbids sleep. Clouds of mosquitoes swarm round him and he feels suffocated.

"At 10 p.m. it has fallen dead calm. The temperature still continues high and our discomfort becomes more depressing than ever. We can neither read nor work, to do so would require an effort of will which we are incapable of making; our mental energy is sapped even more than our physical strength. Night drags on in this painful way unless a thunder-storm falls and we feel a salutary freshness in the air. . . ."

Another unpleasant place is the Punjab in the summer.

"A denizen of the temperate zone can hardly realise the desiccating, truly scorching heat of the wind. When exposed to it, one may imagine he is facing an open furnace. The thermometer rises in the shade to over 120°. . . . After 7 a.m., save of necessity, no European leaves his house, and should business oblige him to do so, he must protect himself from the sun with a sunshade and a thick head-covering. . . . At sunrise, or soon after 5 a.m., houses must be closed, only a small door being left open for communication with the outside world. So long as the hot winds blow strongly and steadily, rooms may still be kept in some measure cool by means of "tatties" or grass screens set up in front of the doorway, and continually sprinkled with water, or by the fan vanes of the so-called 'thermantidote,' which a servant keeps revolving and sprinkles with water; and at night the punkah is worked. Whoever cannot provide himself with these artificial appliances must suffer the daily torment of insupportable and exhausting heat. Man and beast languish and gasp for air, while even in the house the thermometer stands day and night between 95° and 115°. Little by little the European loses appetite and sleep; all power and energy forsake him. Vegetation suffers equally; almost all green things wither; the grass seems burnt up to the roots; bushes and trees seem moribund; the earth is as hard as a paved highway; the ground is seamed with cracks; and the whole landscape wears an aspect of barrenness and sadness. At length, in June, the hot winds cease to blow, and are followed by a calm; and now indeed the heat is truly fearful; grass screens and thermantidotes avail naught; all things pine for the rains; but no rain, not even a shower, can we hope for, till the south and east winds shall have set in."

Senegambia and the Punjab, then, are undesirable places for Europeans; so too is Cherrapunji near the Bay of Bengal. This is the wettest place in the world, its

annual rainfall exceeding the west side of Kamerun peak, which is next wettest, by 46 inches. It is really wet at Cherrapunji. Its mean annual rainfall is 458 inches, and in one year 905 inches actually fell! 41 inches, twice as much as the mean rainfall for the whole year in the east of England, has fallen in a single day.

Where is the best climate to be found? This question is not specially discussed by Mr. Kendrew, but from his material and from known preferences one may arrive at a provisional answer. Of course by "best climate" one usually means the best place to live in, and that depends on several things besides climate—accessibility, natural scenery, the kind of people in the neighbourhood, and so on. But keeping to climate as closely as we can, let us inquire if there are any places outstandingly better than others. Quito has a good name. High up on the Andes plateau in Ecuador it has a remarkable uniformity in temperature and weather generally, from day to day, and from season to season. The temperature throughout the year is much the same as in the south of England in May; a perpetual spring in fact. Its rainfall, however, is nearly twice that of London. It has, moreover, some of the unpleasant features of spring—violent changes from hot sun to chill wind, for example. Another distant place that gets great praise and has been suggested as a suitable permanent home for English settlers is Kashmir. Ellsworth Huntingdon, the geographer, says of that country:

"We are apt to think of Kashmir as part of India, and therefore as necessarily warm. As a matter of fact, it lies 34 degrees north of the Equator, in the same latitude as the northern part of South Carolina. In altitude it stands over 5,000 feet above the sea. Consequently the climate is comparatively cool. From November to March it is so cold as not only to be bracing but even to be rigorous. The spring and autumn are mild and delightful, and the summer is warm. The great amount of water spread over the plain for irrigation, and the summer storms on the mountains make that season damp, though little rain falls on the plain. . . . The temperate climate of the region, combined with the beautiful scenery, makes Kashmir a most attractive summer resort for the people of India, especially the English."

But we must not consider these places seriously. Kashmir is 5,000 feet above the sea, Quito over 9,000 feet. These elevations do not suit everybody—children, for instance. We must keep near sea-level and also we must keep near the sea. For if we get too far inland we have dreadful extremes between winter and summer, and even great changes within twenty-four hours or even great contrast between sunshine and shade. Sir Martin Conway wrote of the neighbourhood of Lake Titicaca in Peru:

"In the winter when the wind blows the frosts are yet more severe, the dry cold is so trying that even the natives cover up their faces in thick woollen masks, and wrap shawls about their heads and ponchos over their bellies. But as soon as the sun is a little way above the horizon, its direct rays scorch the traveller with their great heat, so that he soon begins to pray for the night, as the lesser evil of the two."

We must also examine critically the statements of enthusiasts for particular areas. There are seasons when the south of France or the north of Italy is perfect, but the whole year must be considered. A winter in northern Italy is nearly always the "coldest winter that Italy has ever experienced." In *The Times* we read the following about Capri:

"To-night I shall dine under an orange tree hung with lamps; afterwards I shall sit in a *loggia* and listen to Casella playing César Franck, or to Marinetti reciting 'Baudelaire.' The planet Mars will roll slowly down the southern sky, and the fishing-boats will twinkle until dawn."

But there is another side. In Mr. Kendrew's book we read about the exceedingly hot and dry wind coming from the Sahara which blows over Sicily and southern Italy in the summer. When it arrives "the air is misty, the sky yellowish to leaden, filled with heavy vapours through which the sun can be seen only as a pale disk if at all. Man feels languid and oppressed, and disinclined for mental activity, and animals suffer also from these hot winds. Everyone stays at home as much as possible and does nothing. When the sirocco is especially hot, its scorching breath does great injury to the vegetation; the leaves of the trees curl up and fall off in a few days. If the sirocco sets in when the olive trees and vines are in blossom, a whole year's harvest may be lost. It is usually heralded by a mist which rises over the southern horizon and overspreads the sky. At first the air is quite calm and the sea lies smooth like a mirror, till suddenly with mad gusts the wind bursts and the sea is lashed into waves."

Who indeed shall say where the best climate is to be found? Is it in Java on the Equator where the climate is good and where in addition one always knows when it is going to rain or what the temperature or humidity is going to be? Or in southern California with its four months of almost rainless summer, where the moving picture films are made. Might not even a claim be made for parts of our own country. Many travellers say the climate of the south of England is the best in the world. Charles the Second said so! South-westerly breezes for the most part, very mild winters, cool summers, damp air, much cloud, most rain in autumn; no high levels, no earthquakes, no tornadoes, no insect-pests—perhaps somewhere this might be bettered, but one need not go far from the south of England to fare worse.

A. S. RUSSELL.

Greek Biology and Medicine. By CHARLES SINGER, M.A., M.D. Illustrated. (Oxford: The Clarendon Press, 2*s.* 6*d.*)

This excellent little book forms the first volume of a series of *Chapters in the History of Science* of which Dr. Singer is editor. It contains a reprint of his contri-

butions to the recently published *The Legacy of Greece*, together with a new section upon the biology of Aristotle. The whole is a clear, concise, and well-proportioned summary of a big subject.

The actual achievement of Greek scientific discovery is remarkable, but its yet more important legacy is the scientific attitude of mind, which is characterised by an eager curiosity in the disinterested pursuit of knowledge and the recognition that careful and accurate observation must furnish the basis of such knowledge. It was these qualities which made Aristotle "one of the very greatest investigators of living nature."

Until very recent times the scientific reputation of Aristotle has suffered from the results of his vogue in the Middle Ages, which, owing to their theological approach to the great philosopher, neglected some of his best work in favour of his weaker scientific speculations. Physiology, for example, he approached with philosophical prepossessions, and did not here make the first-hand investigation of detail the basis of his knowledge. But in natural history the careful accuracy of his observations has been strikingly confirmed by modern science. It was not until the nineteenth century, for instance, that the truth of his descriptions of the sexual processes of cephalopods (molluscs with distinct tentacled heads) or of the embryology of the dog-fish was rediscovered anew.

Dr. Singer rightly draws attention to the extraordinarily accurate detail in the representation of animal forms both in Minoan and in early Greek art. Here the artist was the forerunner of the scientist. I can add, from the experience of a prolonged stay in a Greek harbour, a reason for the predilection for forms of marine life which Dr. Singer notices. The crystal clearness of the water makes it possible to study marine life in a way which is impossible off our shores, and the beauty and interest of the scene to be observed by simply looking over the side of a boat is a sufficient incentive whether to artist or scientist.

Greek medicine and surgery equally displayed the scientific spirit. They broke away from the religious and magical treatment of disease, developed the inductive method of determining its natural causes, and based their precepts upon carefully recorded clinical experience.

W. R. Halliday.

Practical Plant Biology : a Course of Elementary Lectures on the General Morphology and Physiology of Plants. By Henry H. Dixon, Sc.D., F.R.S. (Longmans, Green & Co.)

This book embodies the result of many years' teaching experience gained in the School of Botany at Trinity College, Dublin. It consists of a series of thirty lectures designed as "an introductory course in Botany for Medical and other Science students." It is not, as the main title might seem to imply, merely a guide to the practical study of plants, but the practical work schedule at the end of each lecture is an essential feature and enables the student, as far as possible, to test the accuracy of the statements made by the lecturer. Admitting the force of the argument that medical students ought to have some acquaintance with botanical science, the difficult question at once arises : "What kind of course is best fitted to their needs ?" Professor Dixon provides the medical student with an introduction to plant biology which is scientifically accurate, conceived on broad lines, and well written. He omits wisely, though one regrets that more attention is not paid to, the methods of response of plants, particularly the higher plants, to external stimuli. The first lecture deals with the use and construction of the microscope ; this is followed by an account of the cell with special reference to the physical properties of protoplasm—the semi-fluid substance composed of oxygen, hydrogen, carbon, and nitrogen, which is the basis of life in plants and animals. In the two lectures on the yeast plant the student is introduced to crystalloids and colloids and other subjects of supreme importance. The unicellular plant *Chlamydomonas* serves as a basis for an account of sexual reproduction and for a lucid explanation of the truth of the statement that green plants not only supply themselves with food materials and energy, but are "actually the purveyors of food and of the energy of the sun to the whole of living matter." The lectures devoted to bacteria rightly emphasise the part played by these organisms in the general economy of plant life. In the lecture on the red seaweed *Polysiphonia*, a type which some of us would hardly venture to include in a course for beginners, the phenomenon of alternation of generations (i.e. the process by which one generation is produced by asexual spores and the next by sexual cells) is well treated. The alga *Volvox* serves to illustrate the differentiation of a plant into a mortal body or soma and immortal germ-cells. In the treatment of the higher plants Professor Dixon lays stress on the relation between structure and function and on features of special interest from an evolutionary point of view. The book concludes with two admirable lectures on Heredity and the Theory of Descent.

There must be many biologists who can recall the impression made upon their minds by the lecturer who first introduced them to the mysteries of the organic world. The first lecture on biology to many students is no ordinary event ; it may initiate the development of a botanist or zoologist, or it may produce an opposite effect. The importance of stimulating the imagination of students on the threshold of a new subject can hardly be overestimated. A clear account of a plant cell, its contents and its work, a judicial statement of facts that have been demonstrated and of problems that await solution, attract the average student and place him in a position to appreciate the meaning of scientific methods and research. It is sometimes asserted that the more difficult and fundamental problems of life are beyond the grasp of the inexperienced, and therefore should not be included in an elementary course, but it is just those problems which produce keenness and stimulate thought ; and, if treated with a due sense of proportion, they have a considerable educational value. Professor Dixon has produced a book which should do much to encourage the

study of plant biology on eminently sound lines; he has recognised the importance of bringing home to the beginner the necessity of visualising the living plant as a machine performing work and requiring energy.

A. C. SEWARD.

Books Received

(Mention in this column does not preclude a review.)

MISCELLANEOUS

The Story of Mankind. By HENDRIK VAN LOON. Illustrated. (George S. Harrap & Co., Ltd., 12*s.* 6*d.*)

Christ and the New Age. By "A MESSENGER." Edited by G. LEOPOLD. (C. W. Daniel, Ltd., 5*s.*)

Expressionism in Art: Its Psychological and Biological Basis. By DR. OSKAR PFISTER. Translated by Barbara Low, B.A., and M. H. Mügge, Ph.D. Illustrated. (Kegan Paul, Trench, Trübner & Co., Ltd., 6*s.* 6*d.*)

Health in the Factory. The Bournville Scheme. (Publication Department, Bournville Works.)

To the Romans. A Commentary. By ALEX PALLIS. (The Liverpool Booksellers' Co., Ltd.)

Massinger and "The Two Noble Kinsmen." By Prof. A. H. CRUICKSHANK, M.A., D.Litt. (Oxford: Basil Blackwell, 2*s.* 6*d.*)

Sketches from a Library Window. By BASIL ANDERTON, M.A. (Cambridge: W. Heffer & Sons, Ltd., 10*s.* 6*d.*)

Will o' the Wisp, or the Elusive Shakespeare. By GEORGE HOOKHAM. (Oxford: Basil Blackwell, 3*s.*)

Il Platanismo di Platino Sant' Agostino, Cartesio, Leibniz. Ing. GUETANO IVALDI. (Libreria Editrice "La Luce Del Pensiero," Napoli.)

Sir Walter Scott's Scotland. By W. P. KER. (National Home-Reading Union, 1*s.*)

SCIENCE

The Advancement of Science: 1922. (John Murray, 6*s.*) The addresses by the president, and by the thirteen presidents of sections, delivered at the British Association's meeting at Hull in September.

Geology of the Tertiary and Quaternary Periods, and the Palæontology, of the North-West Part of Peru. By T. O. BOSWORTH, D.Sc., M.A., and others. (Macmillan & Co., 45*s.*)

Beyond a few articles in magazines, little has been written about this interesting and economically important territory in South America. The geological surveys which Dr. Bosworth has carried out there in the last ten years are pioneer work, and the descriptions and conclusions therefrom, which make up four-fifths of his book, are wholly new. The four parts of the book which contain new scientific matter relate to the structure and stratigraphy of the Tertiary deposits, the geology of the Quaternary period, the geology of the desert, and the palæontology of the Tertiary deposits. The first three of these are by Dr. Bosworth, and the last by his four collaborators. The fifth part is of a much more popular character, and is a description of the occurrence and exploitation of the petroleum in the district. This is one of those books of which it may be justly said that no expense has been spared in its production. It is well printed, and very fully illustrated with 150 photographs, maps, and diagrams, and 26 plates. It is, of course, a book for technical readers only; a useful addition to geological and oil-field literature.

Elements of Plant Biology. By A. G. TANSLEY, M.A., F.R.S. (George Allen & Unwin, 10*s.* 6*d.*)

This book is intended primarily for medical students and others who do not necessarily intend to continue the study of botany, but who desire or are obliged to obtain some elementary knowledge of plants, particularly in relation to general biology. It will also be useful in the highest forms of schools, but it is not a work for the very young. It aims at providing a course of teaching which shall be as interesting as possible, and shall serve to introduce the student to the fundamental facts and principles of biology, both as part of his training for life, and more particularly as an introduction to the study of medicine. It is based on the first portion of the course in elementary biology at Cambridge (where the author is University lecturer in botany), for the preliminary examination in science and the first examination for the M.B. degree. This portion deals mainly with plants and serves to introduce freshmen, many of whom know nothing whatever about the subject, to biology. It differs from most textbooks of similar scope chiefly in two ways. It devotes more space to biological facts of general significance, illustrating them by a study of the lower forms of plant life. Second, it introduces the student early to the most important substances which make up the body of the organism, and to a brief consideration of some of the physical characters of organic substances and of protoplasm. At the end of each chapter are schedules of practical work, occupying about two hours, based on those in use in the course at Cambridge.

Progress and Science. Essays in Criticism. By ROBERT SHAFER. (Yale University Press; published in the British Empire by Humphrey Milford, Oxford University Press, 12*s.*)

Age and Area. A Study in Geographical Distribution and Origin of Species. By J. C. WILLIS, M.A., Sc.D., F.R.S. (Cambridge University Press, 14*s.*)

General Astronomy. By H. SPENCER JONES, M.A., B.Sc. (Edward Arnold & Co., 21*s.*)

Documents and their Scientific Examination. By C. AINSWORTH MITCHELL, M.A., F.I.C. (Charles Griffin & Co., 9*s.*)

Correspondence

ENGLISH PLACE-NAMES

To the Editor of DISCOVERY

SIR,

It is good news that the purely academic word study of such names is to be co-ordinated with the growing mass of local observation of facts concerning the places.

There is one factor in their meaning so important that in my observation it is the determining influence in at least one-third the place-names. And yet it seems to have been unsuspected and unknown until a year ago. Students have usually looked to some characteristic of the place itself, or of its history, to explain its name. The factor I refer to is the prehistoric straight-sighted trackway on which the place itself stands. Either the type of sighting point which formerly occupied the site, or some characteristic of the entire trackway, or the class of trader coming with his wares along the track, or the type of wares which he brought, are, I find, embedded in hundreds of place-names.

The miller at Rhos-goch (red-marsh) from whom I inquired the name of a lofty hill in sight at the head of a valley told me it was the " Red Hill," and added : " It always puzzles me why, because there never is anything red about the hill, at any time of the day or season of year." I was able to tell him that in the " Kiln-ground Wood " at Whitney-on-Wye (a few miles away) we had discovered the scrap-heaps of an ancient pottery making red-ware, and that I found radiating from this spot straight lines passing through " red " place-names such (to name one track) as Redborough, The Red Lay (a cottage), and the Red House, and that this one line was confirmed as being a track by the fact that it lies for two miles on a road marked " Roman " on the map. I cannot take space to detail how " white " roads radiate from such points of salt production as Droitwich, in straight-sighted tracks through the " White House," Whitwick, Wych Pass, Whitman's Wood, Whiteway, etc., and the kindred proofs (not yet so fully worked out) attaching to black, brown, and gold place-names.

I write this in a farm-house, one of four houses which in about half a mile come exactly in a straight line, which continued passes precisely through churches and other sighting points. The houses are " Lower Raven," " Upper Raven," " Blue Bowl," and " Upper Bowl." The two " Bowl " sites are high knuckles on the track. I have found the same place-name element in another part of the county linking up into a straight line at Bowley Lane, Bowley, and Bowley Field. I can surmise what it means ; it relates either to a sighting point on the track (there is a Bowls Barrow in Wiltshire), or to wares brought along the track. In the former case it would indicate a shape, as I find evidence that the place-name element " bell " does. Valuable as is Professor Skeat's method of studying earlier forms of a word, it is only an adjunct in solving names going back to prehistoric times, not a basis.

If these two places were " bowl " places before the Romans came (as I feel sure they were), it is only an incident in their history to learn how the Anglo-Saxons rendered them.

Yours, etc.,

HEREFORD, ALFRED WATKINS.

September 23, 1922.

[As this letter raises some important points, the Director of the *Survey of English Place-names*, Professor A. Mawer, has kindly written the following note upon it :

It would be very difficult, without much more detailed evidence than is given in Mr. Watkins' letter, to form any just or final conclusion upon his theories. They are based entirely upon the modern forms, and quite apart from any other difficulties which might be raised about Mr. Watkins' views, it makes one rather uneasy that in the only one of his names for which I know of an ancient form, viz. Bowls Barrow in Wiltshire, the early evidence is in direct contradiction of them. The barrow is mentioned in a Saxon Charter (Birch no. 1215) preserved only in a fifteenth-century transcript (the identification is due to Dr. G. B. Grundy), and the form is *bodelusburge*. The first element is obscure, but it is clear that it has no connection with any word *bowl* or *bole* which Mr. Watkins postulates for the explanation of his series of names.]

INTOXICATING HONEY

To the Editor of DISCOVERY

SIR,

May I contribute a scrap of evidence in proof of the toxic qualities of the honey secreted by certain plants ? In my garden in Kent is a flourishing toxic lime-tree which flowers and fruits from two to three weeks later than the British species, and which is raided by many species of bees. During one afternoon this season I counted the carcasses of over one hundred intoxicated bees on the lawn beneath the tree. They fall plumb, stagger or crawl a few yards, and die. If one should happen to recover, she (not unlike certain creatures higher in the animal world) at once returns to her cups. The honey appears to be less fatal to the hive bees, who furnish only about 5 per cent. of the victims.

Yours, etc.,

CAMBRIDGE. T. OKEY.

September 13, 1922.

Continued from p. 294.]

certain areas of the brain, the patient cannot restrain himself from waving his arms about when he hears music, emotional co-ordination and balance having been lost. These facts bring into strong relief the intimate connection between mind and its vehicle, the nervous system. We are not, however, within measurable distance of a complete comprehension of the functions of the brain. One portion is connected with hand movements, another with the interpretation of images on the retina of the eye, but when all has been told the greater part of the brain is included under the term " The Silent Areas," where stimulation in animals has no effect, and disease in man no specific symptoms. And, were we able to map out the brain to the uttermost, the problem of consciousness would not be solved. Some day, as the great French physiologist Claude Bernard prophesied, we may reduce a symphony of Beethoven to the vibration of molecules in the brain —but we will not have elucidated all the mysteries of harmony. Behind the most intimate analysis of psychology and the geography and mechanics of the brain, human individuality still remains the province of the poet rather than the scientist.